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Robo-Advisors: Automated Algorithm-Driven Wealth Management Services - A Literature Review

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ABSTRACT

Purpose: Robo-advisors have transformed personal finance management by offering automated, algorithm-driven financial advice to retail investors. Advances in technology and AI have made these services increasingly popular. This study reviews the literature on the adoption and impact of robo-advisory services, exploring how they influence investor behavior.

Design/Methodology/Approach: This study analyzes the adoption of robo-advisors from 2008 to 2024 by examining secondary data gathered mainly from Google Scholar, along with a selection of papers from Scopus. The focus is on uncovering the key factors that influence investor preferences and evaluating the effectiveness of these automated investment platforms.

Findings: Several factors influence robo-advisory performance, including asset allocation, portfolio management, and rebalancing strategies. Adoption is driven by demographics such as millennials, financial literacy, and trust in technology. Investors with lower risk tolerance and shorter investment horizons, particularly women and older individuals, favor sustainable investments. While AI enhances service personalization, regulatory frameworks remain inadequate, especially regarding risk management. In India, robo-advisors attract younger, male investors, with increased platform use during market volatility. Sustainable and ethical investing is gaining popularity among younger, cost-conscious users. Future research should address regulatory issues, explainable AI (XAI), and anti-money laundering measures in robo-advisory services.

Originality: This study contributes to the literature on robo-advisory by analyzing adoption factors, performance metrics, and investor preferences. It highlights key gaps in current research, especially in regulatory and technological areas, offering a roadmap for future studies.

Paper Type: Review of Literature

KEYWORDS: Robo-advisory | Fintech | Automated investment | Investor preferences | Portfolio management | Adoption factors | Artificial intelligence | Indian investors

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Introduction:

The twenty-first century is recognized as a technological era, where technology permeates every aspect of our lives. Fintech, the fusion of technology and finance, has emerged as a significant force in the financial sector. It refers to the integration of technology and money aimed at benefiting individuals and organisations. One newly popular fintech example is robo advisory. Robo advisory refers to online platforms that advise customers on where to invest their hard-earned money. These FinTech-based financial advisors leverage artificial intelligence and data processing technologies (Bhatia et al., 2020; Tao et al., 2021) to offer investment recommendations with minimal or no human involvement (Hodge et al., 2021; Tao et al., 2021). Robo advisory is transforming how retail investors manage their finances, making wealth management more accessible and cost-effective. The first robo advisor was Wealthfront founded in the United States back in 2008 marked the beginning of robo-advisory, and in 2011 Betterment entered the scene. In 2019, the global total Assets Under Management (AUM) in the robo-advisory sector reached USD 980.54 billion, with the average AUM per user standing at USD 21,421(Statistics, Market Report, 2019). In the Indian context, robo adviser services are still in their nascent stage. The country's growing internet penetration, increased smartphone usage, and advancements in artificial intelligence have paved the way for digital financial services. Robo-advisors in India are primarily offered by fintech startups and established financial institutions, helping retail investors with financial planning, portfolio management, and investment advice at relatively lower costs. Platforms like 5paisa, ET Money, Scripbox, and Kuvera have introduced automated investment services that cater to individuals with diverse financial goals, ranging from retirement planning to wealth accumulation. This paper explores the existing research on robo-advisory services to better understand what drives their adoption, how they perform, and what preferences investors have. By looking at the current findings, we aim to highlight important trends, challenges, and potential areas for future study in this fast-changing field. The relevant articles are included in table 1.

Research Methodology:

This literature review was conducted to systematically explore the evolution and adoption of robo-advisory services from their inception in 2008 to the current landscape in 2024. The investigation focused on secondary data obtained primarily from academic databases such as Google Scholar and Scopus. Utilizing keywords like "robo-advisors," "automated investment," "fintech," and "investor preferences," the search aimed to identify relevant studies and articles that contribute to understanding the factors influencing the adoption of robo-advisors.

Review of Literature:

Table 1: Literature Review on Robo Advisory

Author	Objectives	Findings
Cardillo, G., & Chiappini, H. (2024)	To analyze and classify research articles on robo-advisors from 2017 to 2022 and identify key research streams and questions.	Identified research streams include early classification, behavioral topics, performance, and algorithm modelization; findings offer new research angles for scholars and insights for financial institutions.
Fahruri, A. et al. (2024)	To analyze academic research on the adoption of robo-advisors using econometric literature analysis and identify key metrics such as publication sources, keywords, and authors.	Increasing number of publications on robo-advisors reflects growing interest and potential for future research, highlighting the importance of understanding fintech's impact on wealth management.
Reher, M., & Sokolinski, S. (2024)	To investigate how access to robo-advisors affects the financial investment and welfare of less-wealthy investors.	Middle-class investors experience moderate welfare gains from advanced robo-advisor features, with middle-aged investors benefiting three times more than millennials.
Nain, I. & Rajan S. (2024)	Explore factors influencing the adoption and usage of financial robo-advisors globally.	Positive factors include performance expectancy, effort expectancy, trust in technology, financial knowledge, investing experience, cost-effectiveness, facilitating conditions, and intrinsic motivation; negative factors include anxiety, risk perception, investor age, data security, and behavioral biases.
Fatima, S., & Chakraborty, M. (2024)	Identify drivers of investor adoption for robo-advisors, focusing on trust, anxiety, performance expectancy, and preference for human advisors.	Trust, anxiety, performance expectancy, and preference for human advisors significantly influence investors' intention to adopt robo-advisors.

Author	Objectives	Findings
Bhattacharya, R. (2024)	Review the growth, development, and applicability of robo-advisory financial services in India and identify gaps for further research.	The review presents a clear picture of the evolution of robo-advisory services, aiding researchers and academicians.
Oyewole et al., (2024)	Explore AI's transformative integration into sustainable finance and its impact on aligning financial practices with ESG criteria.	AI technologies, including the FMFG algorithm, enhance dataset processing and sustainable investment decisions, but face ethical, regulatory, and technological challenges.
Orzeszko, W., & Piotrowski, D. (2024)	Construct and examine predictive models to determine consumer acceptance of robo-advisory services in banking.	Predictive models can enhance the effectiveness of promotional activities by targeting customers likely to accept robo-advisory services.
Kuah et al., (2024)	To examine the factors determining the intention to use robo-advisory services among the M40 income group in Malaysia.	Performance expectancy, social influence, hedonic motivation, price value, and trust significantly influence the intention to use robo-advisory services, while effort expectancy and facilitating conditions do not.
Tan et al., (2023)	To investigate the impact of financial knowledge, trust, and usability perception on millennials' adoption of robo-advisory.	Millennials with higher financial knowledge, trust, and perceived usability are more likely to adopt robo-advisory for wealth management
Marano, P., & Li, S. (2023).	To examine the regulation of robo-advisors in insurance distribution under the Insurance Distribution Directive and the draft AI Act, focusing on legal obligations and the effectiveness of current provisions.	Current regulations under the Insurance Distribution Directive and AI Act do not adequately address risks associated with robo-advisors; they are inconsistent and require further legislative and regulatory development.
Ashrafi, D. M. (2023)	To investigate the determinants of willingness to use financial robo-advisory services, focusing on perceived value, risk, and financial knowledge.	Perceived value, risk, and financial knowledge significantly impact consumer acceptance of robo-advisory services; perceived financial knowledge moderates the relationship between perceived value and adoption intention.
Piotrowski, D., & Orzeszko, W. (2023)	To identify factors influencing bank customers' intention to use robo-advisory services and improve banks' promotional activities.	Attitudes towards AI in banking and assessments of financial service ethics are significant factors influencing robo-advisory adoption. Experience with basic financial services is not a major factor.
Eren, B. A. (2023)	Investigate factors influencing robo-advisor usage intention among private pension investors.	Key factors affecting robo-advisor usage intention include performance expectancy, social impact, facilitating conditions, financial risk tolerance, and trust; effort expectancy and need for interaction with service employees do not significantly impact intention.
Tan et al., (2023)	To investigate millennials' adoption of robo-advisory in relation to financial knowledge, trust, and usability perception.	Millennials with higher financial knowledge, perceived usability, and trust are more likely to adopt robo-advisors for wealth management, highlighting the need for improved financial education and user-friendly platforms.
Weber et al., (2023)	The study aims to review current research on Explainable Artificial Intelligence (XAI) in finance, focusing on the methods and goals of XAI used across different finance areas.	The review highlights that XAI methods are well-researched in areas like risk management, portfolio optimization, and stock market applications, but there is a lack of research in anti-money laundering. The study finds that both transparent models and post-hoc explainability are used, with a recent preference for the latter.

Author	Objectives	Findings
Sabir et al., (2023)	To understand customers' attitudes toward adopting robo-advisors and to examine the moderating role of the Technology Readiness Index.	Consumers showed positive attitudes towards robo-advisors, influenced by perceived ease of use, usefulness, and convenience, with Technology Readiness Index dimensions acting as moderators.
Nourallah, M. (2023)	Investigate how young retail investors (YRIs) build initial trust in financial robo-advisors (FRAs) and whether the universal model of FRAs accounts for cultural differences.	Trust propensity, performance expectancy, and hedonic motivation influence initial trust in FRAs, which drives the intention to use these technologies; some cultural differences affect trust formation.
Hou et al., (2023)	This study aims to investigate how the attributes of robo-advisors, risk attitudes, and financial self-efficacy influence customer preferences for adopting robo-advisors.	Increasing annual fees reduce customer preferences, while promotions, investment education, and human assistance are valued; risk-seeking and risk-averse customers need more assistance, high financial self-efficacy leads to a preference for more education and assistance, older and wealthy customers favor promotions and lower fees, guiding providers to tailor services to meet diverse customer needs.
Ashrafi, D. M. (2023)	The study investigates the determinants of willingness to use financial robo-advisory services, focusing on the roles of perceived value, perceived risk, and perceived financial knowledge in consumer acceptance.	The study reveals the intertwined roles of perceived value, perceived risk, and perceived financial knowledge in consumer acceptance of robo-advisory services. It highlights the impact of relative advantage, perceived innovativeness, complexity, and attitude on the adoption intention of robo-advisory services.
Aleksandrova et al., (2023)	To explore AI implementation in finance, insurance, and financial controlling, addressing literature gaps from an economic perspective.	Review of existing literature, identifying trends, themes, and the economic relationship between AI and these sectors.
Aw et al. (2023)	To explore the factors influencing the acceptance of robo-advisory services by examining the interplay of technology, human-like, and consumer characteristics.	Six configurations were found conducive to high acceptance, with perceived anthropomorphism, effort expectancy, security, and intelligence playing critical roles.
Kraiwanit, et al. (2022)	To examine the acceptance of financial robo-advisors in relation to income, investment value, and investment knowledge.	Income, investment value, and knowledge significantly affect the acceptance of robo-advisors, but qualitative research is needed for detailed insights.
Faradynawati, et al. (2022)	To investigate the relationship between investment-related attitudes, demographics, and sustainable investment choices of robo-advisor clients.	Clients with low-risk tolerance, short investment horizon, less wealth, who are female, and older are more likely to choose sustainable investments.
Rico-Pérez et al. (2022)	To investigate the main research topics, key authors, journals, and countries involved in robo-advisor research, using bibliometric analysis.	Research on robo-advisors has grown since 2018, focusing on low-human factor, high-human factor, and compliance aspects; findings are valuable for professionals and researchers.
Nourallah, M., & Öhman, P. (2022)	To analyze how various determinants affect initial trust and behavioral intention to use financial robo-advisors (FRAs) among young retail investors.	Public information, social media information-seeking, and a rational decision style positively influence initial trust in FRAs, which in turn affects the intention to use them; risks studied did not impact initial trust.

Author	Objectives	Findings
Oehler et al. (2022)	To analyze how characteristics of retail investors, such as risk willingness, extraversion, and optimism, influence their decision to use a robo-advisor.	Willingness to take risk and internal locus of control significantly affect robo-advisor usage; users invest more and show differences in investment behavior between those using only robo-advisors and those using both robo-advisors and self-investing.
Kobets, V. (2022)	Develop an algorithm for automated assessment of investment portfolio attractiveness, comparing multiple criteria evaluation methods and ranking investment projects.	The algorithm effectively assesses portfolio attractiveness, demonstrated through scoring different investment portfolios, including cryptocurrencies, to identify the most attractive options
Filiz et al. (2022)	To investigate how algorithm aversion affects the adoption of robo-advisors in decision-making tasks.	Despite the robo-advisor's efficiency, subjects only used it about 40% of the time, exhibiting algorithm aversion and making suboptimal decisions.
Oehler et al. (2022)	Analyze how characteristics of retail investors influence their decision to use a robo-advisor.	Risk willingness and internal locus of control are significant factors influencing robo-advisor use; users invest more and are more likely to also invest independently.
Dietzmann et al. (2022)	Investigate the impact of AI-based robo-advisory (RA) on private banking (PB) investment advisory to derive process redesign knowledge and strategic guidance.	AI systems enable seamless client journeys, increase advisor flexibility, support client-advisor relationships through omnichannel approaches, and require advisors to augment technical and statistical skills.
Dietzmann et al. (2022)	To analyze the impact of AI-based robo-advisory on the private banking investment advisory process and derive process redesign knowledge and strategic AI guidance.	AI systems facilitate seamless client interactions, enhance advisor flexibility, support omni-channel client-advisor relationships, and necessitate the augmentation of advisor skills with technical and statistical expertise.
Darskuviene, V., & Lisauskiene, N. (2021)	To provide insights on the future research agenda regarding the relationship between Robo-advisors and behavioral biases in individual investors.	Robo-advisors can reduce biased decisions but may cause investor alienation from the stock market, potentially widening gaps between different investor groups.
Au et al. (2021)	To examine characteristics of German private investors influencing the probability of using robo-advisory services.	Awareness of sustainable aspects, being male, and cost-awareness positively affect the use of sustainable robo-advisors; young and experienced investors are more likely to use them.
Zhang et al. (2021)	Investigate differences in consumer perceptions of trust, performance expectancy, and intention to hire between human financial advisors (high/low expertise) and robo-advisors.	Consumers prefer human financial advisors with high expertise over robo-advisors, with no significant differences in performance expectancy or intention to hire between robo-advisors and novice financial advisors.
Bhaulkaran, V. (2021)	Analyze the demographic characteristics, investment behavior, and returns of users of robo-advisory services in India.	Users of robo-advisory services in India are typically young, male, married, small investors, and professionals. SIP investors and those with diversified portfolios tend to generate positive risk-adjusted returns. User account creation increases during periods of high market volatility.
Baek et al. (2020)	To apply machine learning to ETF investments, using predictive models to detect long or short investment signals based on U.S. economic and market indicators.	The predictive model successfully identifies long or short ETF signals based on momentum probabilities, and the trading system demonstrated robust performance in both in-sample and out-of-sample periods.

Author	Objectives	Findings
Hildebrand, C., & Bergner, A. (2020)	To investigate how conversational robo-advisors influence trust, firm evaluation, and consumer financial decision-making compared to non-conversational robo-advisors.	Conversational robo-advisors enhance affective trust, lead to more positive firm evaluations, and result in increased recommendation acceptance and asset allocation.
Ahn et al. (2020)	To propose and test a model that automates portfolio management using an instability index and genetic algorithms (GAs).	The proposed model demonstrates better performance and a higher Sharpe ratio compared to traditional models.
Waliszewski, K., & Warchlewska, A. (2020)	To diagnose the sociological and economic determinants underlying consumer satisfaction with robo-advisory financial services.	Socioeconomic characteristics significantly impact satisfaction with robo-advisory services and AI-driven suggestions.
Beck, A. D. (2020)	To explore how artificial intelligence can be applied in predicting consumer behavior and financial markets within the realm of robo-advisory.	AI enhances robo-advisory by enabling personalized consumer interactions and advanced asset management, but also presents certain limitations.
Puhle, M. (2019)	To evaluate the performance of five German robo-advisors during the period May 2015 to December 2018 using Sharpe's (1966) and Jensen's (1968) methodologies, and to determine if differences in performance can be explained by asset allocation using returns-based style analysis.	Differences in robo-advisor performance may be attributed to factors beyond asset allocation, including portfolio implementation and re-balancing. Choosing the right robo-advisor is crucial, as even portfolios with similar asset mixes can have divergent performance outcomes.
Cheng et al. (2019)	To investigate the trust influencing mechanisms of robo-advisors using a mixed method approach and to extend the literature on trust in fintech.	Supervisory control plays a significant role in trust; the study validates relationships among trust factors and reveals differences between junior and senior investors.
Beketov et al. (2018)	To analyze the core portfolio optimization and asset allocation methods used in robo-advisors (RAs), including their prevalence, asset volumes, and future prospects.	Modern Portfolio Theory is the primary method used in robo-advisors, with a trend towards improving existing methods rather than developing new ones; systems using advanced methods generally manage more assets.
Salampasis, D. (2017)	To explore how robo-advisors can help institutionalize Socially Responsible Investing (SRI) strategies in the fund management industry.	Robo-advisors introduce innovation in the SRI marketplace, aiding in the institutionalization of SRI strategies for social good.
Jung et al. (2017)	To identify requirements and design principles for robo-advisory systems and evaluate them for improved consumer adoption.	The evaluation confirmed the validity of the identified design principles for robo-advisory systems.

Discussion:

The performance of robo-advisors is shaped by more than just asset allocation. Factors like portfolio implementation and rebalancing also play a critical role. Research shows that even portfolios with similar asset mixes can produce different outcomes, underscoring the importance of choosing the right robo-advisor. Adoption of these services, particularly among millennials, is often influenced by their level of financial knowledge and trust in technology. Factors such as income, the size of the investment, and financial literacy are frequently highlighted as key drivers in the decision to use robo-advisors.

Investors' preferences also vary based on risk tolerance, investment horizons, and demographics. For example, individuals with lower risk tolerance, shorter investment timeframes, and older investors, especially women, show a preference for sustainable investments. Trust in robo-

advisors is often shaped by the information available through public and social media channels. Meanwhile, technological advancements such as AI have enhanced the personalization of robo-advisory services, but regulatory frameworks have not kept pace. Many studies point out that current regulations fall short in addressing the risks introduced by these platforms, calling for further regulatory development.

In India, robo-advisors primarily attract young, male investors, and there is a notable surge in platform use during market volatility, reflecting the growing trust in technology for wealth management. Additionally, robo-advisors are playing an increasing role in promoting sustainable and socially responsible investments (SRI). Younger, cost-conscious, and more experienced investors are more inclined to adopt these services for sustainable investing.

Future Scope:

The growing interest in the impact of fintech on wealth management highlights several areas for further research and development in robo-advisory systems. As AI algorithms become more advanced, the need for explainable AI (XAI) will be crucial for enhancing transparency and building trust among users. Additionally, regulatory frameworks, particularly in developing markets like India, require significant attention to address issues such as data privacy and anti-money laundering. Future advancements in AI are expected to enable robo-advisors to provide even more personalized financial advice, particularly for groups that have historically been underserved. The increasing demand for sustainable and ethical investing, especially among younger generations, presents another promising avenue, where platforms can focus on incorporating Environmental, Social, and Governance (ESG) criteria into their strategies. Moreover, integrating behavioral finance to tackle investor biases and exploring hybrid models that combine human and robo-advisors offer valuable directions for future exploration. These emerging trends and research gaps present exciting possibilities for the future of robo-advisory systems.

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Annexure 16.2.11

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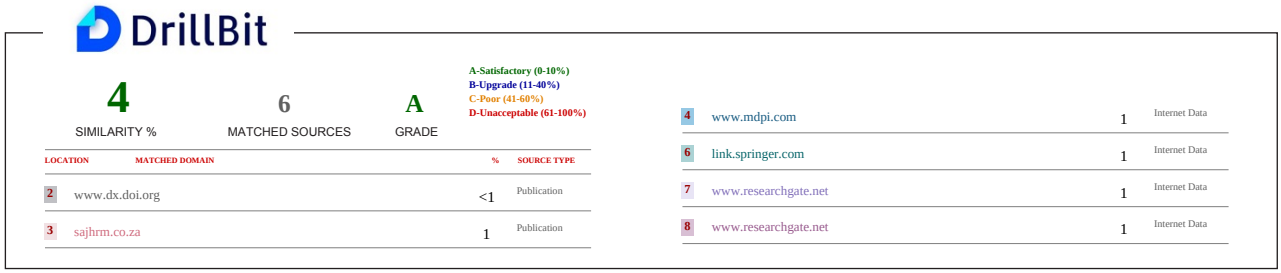

Reviewers Memorandum

Reviewer's Comment 1: The paper offers in-depth literature review on the trends in robo-advisory adoption, covering the period from 2008 to 2024. Literature provides crucial factors that lead to the adoption of robo-advisory such as for millennials, their level of financial knowledge, income, trust in technology, financial literacy, and size of the investment are some of the crucial factors in the decision of opting for robo-advisors. Inclusion of studies from developed and developing countries enhances the strength of study's findings.

Reviewer's Comment 2: This paper provides literature on robo-advisory comprehensively. However, there is a lack of the process of extracting data from the database and criteria for inclusion and exclusion of the papers, which could enhance the transparency of the findings and enhance the replicability of the study. In conclusion, the manuscript performs a good job and throw light on the area where future research in the domain of robo-advisory systems is required specifically, need for explainable AI, regulatory framework, issues such as data privacy, anti-money laundering, robo-advisors are required to offer more personalized financial services.

Reviewer's Comment 3: This manuscript includes in-depth literature on the trends in robo-advisory adoption. The literature section has more emphasis on empirical studies from developed nations. Hence, there is a lack of inclusion of studies from emerging markets, where different cultural, subcultural, and socio-economic factors could influence consumer behavior.

Citation

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Editorial Excerpt

The article has 4% of plagiarism which is the accepted percentage as per the norms and standards of the journal for publication. As per the editorial board's observations and blind reviewers' remarks the paper had some minor revisions which were communicated on a timely basis to the authors (Parveen, Subodh Kesharwani, Aditya Prakash and J. D. Gangwar), and accordingly, all the corrections had been incorporated as and when directed and required to do so. The comments related to this manuscript are noticeably related to the theme "Robo-Advisors: Automated Algorithm-Driven Wealth Management Services - A Literature Review" both subject-wise and research-wise. This manuscript provides a well-structured and in-depth literature review on robo-advisory system, capturing key trends in the domain over the past sixteen years. Still the manuscript would be strengthened by discussing robo-advisory system in diverse socio-economic contexts, particularly in emerging markets. After comprehensive reviews and the editorial board's remarks, the manuscript has been categorized and decided to publish under the "Review of Literature" category.

Acknowledgement

The acknowledgment section is an essential part of all academic research papers. It provides appropriate recognition to all contributors for their hard work and effort taken while writing a paper. The data presented and analyzed in this paper by (Parveen, Subodh, Aditya & Gangwar) were collected first handily and wherever it has been taken the proper acknowledgment and endorsement depicts. The authors are highly indebted to others who facilitated accomplishing the research. Last but not least, endorse all reviewers and editors of GJEIS in publishing in the present issue.

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