Multidisciplinary Reviews

REVIEW ARTICLE
Published Online: June 16, 2025
https://doi.org/10.31893/multirev.2025379

Integrating generative AI in Robo-Advisory: A systematic review of opportunities, challenges, and strategic solutions

Mahan Tahvildari[a]

[a]Faculty of Economics and Business, UCAM Catholic University of Murcia, Spain.

Abstract The integration of generative AI into financial advisory services marks a significant advancement in portfolio optimization, risk assessment, and decision support and recent developments in large language models (LLMs), such as ChatGPT, have demonstrated the ability to process both structured financial data and unstructured market sentiment, enhancing the accuracy and adaptability of investment recommendations. However, the application of generative AI in robo-advisory systems presents ethical, regulatory, and psychological challenges and this study conducts a systematic literature review to examine the technological benefits of AI-driven financial advisory, while also addressing concerns related to algorithmic bias, explainability, and user trust. The review applies a TOWS-based strategic framework to analyze strengths, weaknesses, opportunities, and threats (SWOT) in the adoption of AI-enhanced robo-advisors. Findings consequentially indicate that explainable AI (XAI) and hybrid AI-human oversight models are critical for mitigating transparency concerns and algorithm aversion. While real-time data processing improves investment insights, the black-box nature of generative AI remains a key barrier to regulatory compliance and consumer adoption. Additionally, regulatory fragmentation across jurisdictions complicates AI governance, necessitating adaptive compliance strategies and cross-border cooperation. The research further highlights that financial literacy and trust-building mechanisms, including user-centric onboarding and transparent risk assessments, are essential for overcoming psychological resistance to algorithmic decision-making. In conclusion, the paper proposes an approach for integrating generative AI into robo-advisory systems, combining advanced financial analytics, XAI, human oversight, and ethical AI governance. Future research should focus on empirical evaluations of hybrid advisory models, regulatory harmonization, and AI-driven financial education tools to ensure responsible adoption. These findings contribute to the growing discourse on sustainable and user-centric AI deployment in financial services, providing strategic recommendations for industry practitioners and policymakers.

Keywords: artificial intelligence, chatgpt, robo advisor, explainable ai (xai), financial technology

1. Introduction

The digital transformation in wealth management has led to the emergence of automated wealth management solutions, known as robo-advisors (Jung et al., 2019). In the robo-advisory market, assets under management (AuM) are projected to reach USD 2.06 trillion in 2025, with an expected compound annual growth rate of 3.66% between 2025 and 2029, reaching a total of USD 2.38 trillion by 2029, with average AuM per user reaching USD 61.9k in 2025, and the United States standing out globally with the highest projected assets under management of USD 1.67 trillion in 2025 (Statista GmbH, 2024).

The integration of artificial intelligence (AI) into financial services signifies the onset of a novel era of innovation, with robo-advisory systems emerging as prominent applications that automate portfolio management and deliver customized investment advice. Recent developments in generative AI, exemplified by large language models (LLMs), such as ChatGPT, provide unprecedented capabilities in synthesizing large, heterogeneous datasets to inform more precise and adaptive financial recommendations (Khan et al., 2025; Oehler & Horn, 2024), and these models can help uncover hidden patterns in historical financial datasets while adapting to rapidly changing contexts (Zheng et al., 2024). By combining structured financial data with unstructured sources, ranging from real-time news to social media, generative AI offers a multidimensional view of market dynamics (Romanenko et al., 2023; Zhu et al., 2024). This could already be witnessed when researching how machine learning techniques can enhance market simulations, enabling improved risk assessments and scenario analyses (Weber, Carl, & Hinz, 2024). Furthermore, real-time data integration through advanced application programming interfaces (APIs) can increase the accuracy of AI-driven predictions, especially in volatile markets (Ko & Lee, 2024).

Despite such promise, the introduction of generative AI into robo-advisory systems brings a range of complexities: (a) ethical issues—particularly biases embedded in historical training datasets—pose serious concerns for transparency and fairness (Zhu et al., 2023; Kofman, 2024; Adeyelu et al., 2024; Wang, 2024), and (b) regulatory frameworks, although evolving,

 Received: February 21, 2025 | Accepted: May 27, 2025

often lag behind new technological breakthroughs and emerging technologies, resulting in gaps in oversight (Montagnani et al., 2024; Niszczota & Abbas, 2023; Lee et al., 2024; Crisanto et al., 2024). Moreover, (c) psychological barriers, such as algorithm aversion and mistrust of opaque AI processes, further complicate broad acceptance (Walter et al., 2022; Baek & Kim, 2023; Dwork & Minow, 2022; Maier et al., 2022).

To the best of the author's knowledge, there has not yet been a systematic review of the applications of generative AI in robo-advisory. This paper aims to close this research gap and provide a basis for further research. It addresses the question of how generative AI models, such as ChatGPT, can be integrated into robo-advisory systems to enhance portfolio optimization and decision support. Furthermore, it focuses on how to do so ethically, within regulatory frameworks, and by recognizing the psychological challenges that shape user perception and financial decision-making. To answer this question, this paper analyzes the technological, ethical, regulatory, and psychological dimensions of integrating generative AI into robo-advisory systems by conducting a systematic and state-of-the-art literature review to discuss how user trust and engagement can be fostered through transparent design, explainable AI (XAI), and culturally adaptable interfaces. Hence, this study contributes to the field by systematically analyzing the integration of generative AI within robo-advisory systems. Specifically, it examines both the technological advantages and potential pitfalls of AI-driven financial decision-making, including algorithmic opacity, user distrust, and regional inconsistencies in regulatory compliance. Accordingly, the primary objectives of this work are threefold: (1) to illustrate how generative AI enhances advisory performance, (2) to identify and address ethical and regulatory dilemmas, and (3) to provide strategic frameworks for responsible, transparent adoption that fosters user trust.

2. Materials and Methods

The method for conducting systematic literature reviews, as developed by vom Brocke (2009), represents a structured approach to systematically capture, evaluate, and synthesize the existing body of knowledge within a specific research domain. This process begins with a clear definition of the objectives of the literature review, including the formulation of specific research questions and the determination of the scope of the investigation. A conceptual framework forms the backbone of the literature review, serving as a guide to systematically identify and organize key theories and concepts. This framework is typically developed through a preliminary literature search, which aids in recognizing central terms and relationships within the existing body of research.

The actual literature search requires a systematic and comprehensive approach to ensure the identification of all relevant studies. This includes the use of various academic databases, combined with the application of specific keywords and search terms. Furthermore, it is critical to define clear inclusion and exclusion criteria to ensure the quality and relevance of the collected literature (vom Brocke, 2009).

A systematic literature review was conducted to evaluate current research on AI robo-advisory systems. The search string "AI Robo Advisor" was applied to three databases—Springer, ScienceDirect, and CINAHL—within a publication time frame from 2022 to 2025. Only research articles or academic journals were included, as illustrated in Figure 1.

In total, 25 articles were identified and analyzed across these databases. The review focused on empirical research, case studies, and conceptual analyses related to the integration of generative AI into robo-advisory systems, encompassing technological advancements, ethical considerations, regulatory frameworks, and psychological dimensions.

3. Results and Discussion

The literature sources are categorized by content, and the results are then presented individually in each category. Table 1 shows an overview of all the studies selected for this literature review.

3.1. Technological advancements

Generative AI transforms robo-advisory by enabling advanced portfolio optimization, risk assessment, and market sentiment analysis. Models such as ChatGPT excel at extracting intricate patterns from unstructured data, such as social media feeds and news articles, thereby providing nuanced insights that traditional algorithms often overlook (Romanenko et al., 2023; Zhu et al., 2024; Oehler & Horn, 2024). Ko and Lee (2024) suggested that integrating dynamic sentiment analysis tools via real-time APIs can bolster adaptive and accurate predictions because, unlike conventional robo-advisors, generative AI continually learns from new inputs, refining strategies as conditions evolve.

However, the complexity of these models often introduces transparency challenges. The implementation of explainable AI frameworks is critical for clarifying how recommendations are generated (Zhu et al., 2023; Montagnani et al., 2024). In addition, explainability improves user understanding and trust, particularly in autonomous systems where decision-making processes can appear opaque (Flavián et al., 2022; Oehler & Horn, 2024).

3.2. Human oversigh and hybrid approaches

While generative AI offers superior data processing capabilities, it also introduces risks related to algorithmic bias and overreliance on historical data (Khan et al., 2025; Cao et al., 2024), making hybrid models that merge AI-driven computational

efficiency with human oversight to detect and correct inaccuracies or discriminatory outcomes inevitable (Karataş & Cutright, 2023). The goal is to solve ethical problems and promote user trust by ensuring that the results of AI are subject to professional evaluation. This can be achieved by using XAI methods, which emphasise the need for openness in order to build trust and assess the reliability of AI (Zhu et al., 2023).

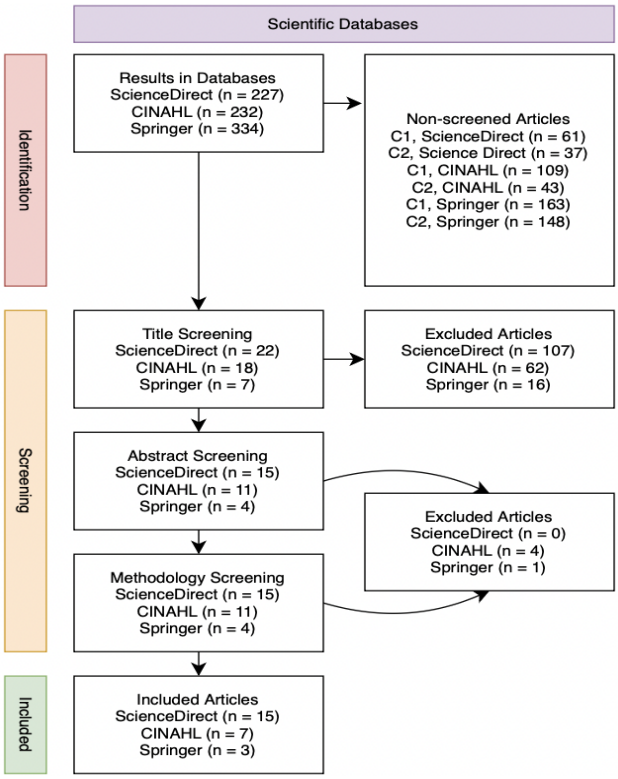

Figure 1 Search strategy for the literature review.

Anthropomorphic features, including conversational avatars, can further alleviate skepticism, with Baek and Kim (2023) stating that empathetic design fosters emotional connections, reducing users' resistance to algorithmic recommendations. Similarly, perceptions of AI intelligence significantly influence adoption rates for complex financial decisions (Walter et al., 2022), which further emphasizes the importance of hybrid frameworks, particularly in high-stakes financial environments, where human involvement ensures a balance between innovative insights and risk mitigation (Pelster & Val, 2024). Nonetheless, relying on human-like interfaces without genuine explanatory mechanisms risks superficial trust, underscoring the importance of XAI and ongoing bias audits.

3.3. Ethical challenges

Generative AI systems inherit biases embedded in historical data, creating the risk of discriminatory recommendations (Kofman, 2024; Zhu et al., 2023). These biases disproportionately affect marginalized groups, potentially deepening existing financial inequalities. Gómez-Martínez and Medrano-Garcia (Gómez-Martínez & Medrano-Garcia, 2025), for example, highlight that biased advisory services in underserved regions can exacerbate inequities.

Mitigating bias demands proactive strategies, with researchers advocating continuous bias monitoring and model recalibration to ensure fair outcomes (Manrai & Gupta, 2023). Transparency mechanisms, such as XAI, enable stakeholders to scrutinize how algorithms reach specific conclusions, fostering accountability, which is even more important in the context of robo-advisory platforms handling sensitive personal and financial data. Data breaches therefore pose significant risks to banking, financial, and insurance services (Pathak & Bansal, 2024). Without robust encryption protocols and user-friendly consent mechanisms, unauthorized access may compromise user privacy and damage public trust, thereby leading to strong data encryption, stringent access controls, and regulatory adherence, such as data protection regulations in the European context, which are essential key factors (Zhu et al., 2024). Researchers argue for adaptive privacy frameworks, allowing platforms to scale protection in accordance with rapidly changing regulations (Ko & Lee, 2024). Internal ethical audits can further ensure that evolving security vulnerabilities are promptly addressed.

3.4. Regulatory challenges

Current regulations often focus on broad principles of data protection and risk management. Initiatives such as the European Union's AI Act illustrate progress toward harmonized legal frameworks, emphasizing ethical and transparent AI (Montagnani et al., 2024). However, the dynamic nature of generative AI complicates compliance, as models can evolve after deployment, leaving regulators trailing behind continuous technological advances (Khan et al., 2025). The black-box complexity of generative AI further aggravates interpretability issues, raising questions about accountability in the event of flawed financial advice (Zhu et al., 2024; Kofman, 2024). Additionally, biases in training datasets can persist, contravening fairness principles if not proactively addressed (Fatima & Chakraborty, 2024). Given the global reach of financial markets, cross-border cooperation is necessary to mitigate disparities in regulation and consumer protection (Niszczota & Abbas, 2023; Pisoni & Díaz-Rodríguez, 2023).

Table 1 Categorization of the selected literature sources by contente.

Category	Results	Sources
Technological advancements	Generative AI enhances robo-advisory by improving portfolio optimization, risk assessment, and sentiment analysis. It adapts dynamically but raises transparency challenges, necessitating explainable AI.	Romanenko et al. (2023); Zhu et al. (2024); Oehler and Horn (2024); Ko and Lee (2024); Zhu et al. (2023); Montagnani et al. (2024); Flavián et al. (2022)
Human oversight and hybrid approaches	Hybrid models combining AI efficiency with human oversight mitigate bias and ensure accuracy. XAI frameworks enhance trust, while anthropomorphic design fosters user engagement. However, AI must provide real explainability to avoid superficial trust.	Khan et al. (2025); Cao et al. (2024); Karataş and Cutright (2023); Zhu et al. (2023); Baek and Kim (2023); Walter et al. (2022); Pelster and Val (2024)
Ethical challenges	Generative AI inherits biases from historical data, risking discriminatory recommendations, especially in underserved regions. Continuous bias monitoring, XAI, and strong encryption are essential to ensure fairness, privacy, and regulatory compliance.	Kofman (2024); Zhu et al. (2023); Gómez-Martínez and Medrano-Garcia (2025); Manrai and Gupta (2023); Pathak and Bansal (2024); Zhu et al. (2024); Ko and Lee (2024)
Regulatory challenges	AI regulations, like the EU AI Act, promote transparency but struggle with evolving models. Licensing proposals (e.g., AIRAL) and XAI integration support compliance. Global cooperation is crucial for consistent AI oversight.	Montagnani et al. (2024); Khan et al. (2025); Zhu et al. (2024); Kofman (2024); Fatima and Chakraborty (2024); Niszczota and Abbas (2023); Pisoni and Díaz-Rodríguez (2023); Roh et al. (2023); Karataş and Cutright (2023)
Psychological challenges	Algorithm aversion & perceived complexity: Users distrust AI-driven financial advice due to perceived opacity and complexity. XAI and empathetic design help counter skepticism. Emotional & cognitive responses: AI errors impact user confidence, with financial literacy shaping adoption. AI-human interaction must balance engagement and trust. Impact on perception & decision-making: Generative AI reduces biases but may encourage overreliance, making transparency, localization, and regulatory compliance essential for adoption.	Walter et al. (2022); Zhu et al. (2023); Baek and Kim (2023); Ashrafi (2023); Singh and Kumar (2025); Ashrafi and Kabir (2023); Ko and Lee (2024); Fatima and Chakraborty (2024); Roh et al. (2023); Karataş and Cutright (2023); Ullah et al. (2024); Pathak and Bansal (2024); Khan et al. (2025); Montagnani et al. (2024); Niszczota and Abbas (2023); Zhu et al. (2024)
Frameworks and best practices for AI integration	XAI, visual aids, and interactive tutorials improve transparency and user understanding. Compliance frameworks like AIRAL support ethical AI, while continuous monitoring and cybersecurity ensure fairness and accountability. Human-in-the-loop (HITL) models enhance trust, and features like risk customization and real-time dashboards encourage engagement.	Zhu et al. (2024); Zhu et al. (2023); Baek and Kim (2023); Gómez-Martínez and Medrano-Garcia (2025); Kofman (2024); Montagnani et al. (2024); Khan et al. (2025); Romanenko et al. (2023); Ullah et al. (2024); Fatima and Chakraborty (2024)

Emerging proposals, such as the *AI Robo-Advice License* (AIRAL) by Kofman (2024), offer structured licensing and continuous monitoring to promote transparency, safety, and bias reduction. In addition to mandatory ethical scorecards, these frameworks require regular audits of AI systems, ensuring that accountability mechanisms keep pace with evolving technology. Integrating XAI techniques into legal requirements will help with enforcing minimal standards for interpretable decision-making (Montagnani et al., 2024).

Regionally, especially in the United States, it often opts for self-regulatory guidelines complemented by industry-specific measures from bodies such as the *Securities and Exchange Commission* (SEC), whereas the Asia-Pacific region features a patchwork of regulations, reflecting diverse economic and technological conditions (Roh et al., 2023). However, a streamlined international agreement could mitigate inconsistent enforcement by promoting consistent standards for generative AI, not just in financial services (Karataş & Cutright, 2023).

3.5. Psychological challenges

3.5.1. Algorithm aversion and perceived complexity

User trust in robo-advisory systems is frequently undermined by the opaque nature of AI algorithms, and research indicates that individuals can be quick to reject algorithmic advice if it appears less trustworthy or if errors are discovered (Walter et al., 2022; Zhu et al., 2023). Algorithm aversion occurs when users revert to human advisors upon perceiving AI-driven suggestions as inferior or impersonal (Baek & Kim, 2023), which leads to AI-based robo-advisory services and their intention and absurdum and fosters trust issues, perceived complexity, and anxiety around automated processes, therefore often deterring potential adopters (Ashrafi, 2023; Singh & Kumar, 2025). In contrast, a clear understanding of AI capabilities can mitigate concerns and foster more positive attitudes (Ashrafi & Kabir, 2023; Zhu et al., 2023).

Generative AI exacerbates these concerns through its sophisticated processes, specifically the use of dynamic visualizations and user-centric onboarding to reduce perceived complexity, particularly among less financially literate individuals (Ko & Lee, 2024). Empathetic AI features, such as conversational styles, can also ameliorate trust deficits, although they must be supported by genuine transparency to avoid superficial engagement (Fatima & Chakraborty, 2024).

3.5.2. Emocional and cognitive responses

Financial decisions often carry emotional weight, making users more sensitive to errors or biases in AI-driven advice (Roh et al., 2023); however, human-like interactions, particularly those involving empathetic avatars, can ease resistance by providing an emotionally resonant user experience (Karataş & Cutright, 2023). However, reliance on anthropomorphic design without improving the underlying explainability may lead to fragile user trust that dissolves under performance fluctuations, particularly influenced by the moderating effect of financial literacy. While more knowledgeable users may feel more comfortable with AI and interpret algorithmic output in a balanced manner, less knowledgeable investors may struggle to contextualize advanced analytics, leading to the aforementioned reliance on AI systems without critically evaluating their advice (Ullah et al., 2024). Tailored educational tools and scenario-based learning can help bridge these gaps, fostering informed decision-making (Fatima & Chakraborty, 2024; Zhu et al., 2023).

3.5.3. Impact on user perception and financial decision-making

Furthermore, generative AI has the potential to reduce heuristic-driven biases, offering data-driven alternatives that improve portfolio performance. In particular, AI-based recommendations often result in more systematic and objective evaluations of market trends (Khan et al., 2025), yet overreliance on automated advice may erode critical thinking, particularly among users with limited financial literacy (Pathak & Bansal, 2024; Fatima & Chakraborty, 2024).

Robo-advisors leveraging ChatGPT-like models also influence user perception by framing investment choices via real-time sentiment analysis. Montagnani et al. (Montagnani et al., 2024) reported that transparent disclosure of data sources and algorithmic rationales enhances perceived credibility and user satisfaction. Conversely, opaque systems risk undermining confidence, restricting the adoption of AI-based financial tools (Zhu et al., 2023).

In emerging markets, concerns around data security and limited regulatory safeguards amplify psychological and adoption barriers (Ko & Lee, 2024), making context-specific adjustments—such as language localization, culturally relevant risk profiles, and regionally tailored guidelines—critical factors for expanding the user base (Zhu et al., 2024). As Niszczota and Abbas (2023) observe, robo-advisors that incorporate local nuances tend to achieve broader acceptance and higher customer satisfaction.

3.6. Frameworks and best practices for AI integration

Designing effective robo-advisors requires balancing cutting-edge technology with user accessibility and transparency. Explaining algorithmic outputs through XAI approaches clarifies how specific decisions are made (Zhu et al., 2024; Zhu et al., 2023), whereas visual aids, interactive tutorials, and anthropomorphic interfaces can further demystify complex analytics (Baek & Kim, 2023; Gómez-Martínez & Medrano-Garcia, 2025).

Compliance frameworks such as AIRAL further support transparency by featuring licensing protocols, regular ethics scorecards, and bias audits (Kofman, 2024), which align with the EU AI Act and other global initiatives aiming to standardize ethical, transparent AI. Continuous monitoring, combined with cybersecurity certifications, results in a generative AI that

remains fair, secure, and accountable (Montagnani et al., 2024), with local and international regulations being especially vital in fragmented markets, where disparate rules can undermine user trust and system reliability (Khan et al., 2025).

Building trust in generative AI also mandates user education, consistent system performance, and meaningful explainability and human-in-the-loop (HITL) approaches, wherein AI outputs are periodically reviewed by financial experts, which can rectify biases and increase user confidence (Romanenko et al., 2023). Additional features, such as customizable risk settings and interactive what-if scenarios, enhance perceived control, prompting more active engagement (Ullah et al., 2024), resulting in, for example, user feedback loops and real-time performance dashboards to promote an environment of transparency and continuous improvement. Integrating these elements into robo-advisory systems can help mitigate algorithm aversion, ensuring that generative AI functions as a trusted partner rather than an opaque authority (Fatima & Chakraborty, 2024).

The following SWOT analysis evaluates the integration of generative AI into robo-advisory systems, highlighting key factors influencing its adoption and effectiveness. Strengths include advanced portfolio optimization, allowing AI to enhance risk assessment and investment strategies, and hybrid human-AI collaboration, ensuring oversight, bias mitigation, and user trust. However, weaknesses such as opacity and explainability gaps undermine transparency, whereas overreliance on historical data may reinforce biases.

Among these opportunities, the deployment of XAI can improve transparency, fostering greater trust, whereas global expansion through culturally adaptable interfaces enables broader adoption. Conversely, threats (4) include evolving regulatory landscapes, which challenge compliance, and persistent algorithm aversion, where users may reject AI-driven financial advice owing to perceived complexity or distrust. The results of the SWOT analysis are presented in Table 2.

Table 2 SWOT analysis.

Strengths	Weaknesses
Advanced Portfolio Optimization	Opacity and Explainability Gaps
Hybrid Human-AI Collaboration	Over-Reliance on Historical Data
Opportunities	Threats
Deployment of XAI to Boost Transparency	Evolving Regulatory Landscapes
Global Expansion with Culturally Adaptable Interfaces	Persistent Algorithm Aversion

The integration of generative AI into robo-advisory systems clearly represents a paradigm shift in financial decision-making, necessitating a structured approach to balance technological advancements with regulatory compliance, ethical responsibility, and user trust, and to achieve this, four strategic measures shown in Table 3 have been identified, each addressing specific strengths, weaknesses, opportunities, and threats associated with AI-driven financial advisory services.

Table 3 SWOT analysis with TOWS strategies.

	Strengths	Weaknesses
Opportunities	SO Strategy	WO Strategy
	Leveraging advances optimization and XAI for global reach	Deploying XAI to overcome opacity and bias
Threats	ST Strategy	WT Strategy
	Strengthening compliance and trust through hybrid oversight	Enhancing transparency and data governance to mitigate risks

The first strategy leverages advanced portfolio optimization and XAI for global expansion. Generative AI excels in extracting patterns from unstructured data, such as market sentiment from social media or real-time economic indicators, allowing for superior risk assessment and investment strategy refinement (Ko & Lee, 2024; Zhu et al., 2024). However, AI adoption is hindered by opacity, particularly in culturally diverse financial markets, and by integrating XAI, robo-advisory systems can enhance transparency, making AI-driven decisions more interpretable while encouraging trust among users with varying levels of financial literacy (Montagnani et al., 2024). Moreover, culturally adaptable interfaces, tailored risk profiles, and localized regulatory adjustments can drive wider adoption in emerging markets (Niszczota & Abbas, 2023).

To overcome opacity and bias, the use of XAI alongside continuous model recalibration is therefore critical. Generative AI inherits biases from historical data, potentially leading to discriminatory financial recommendations (Kofman, 2024; Gómez-Martínez & Medrano-Garcia, 2025). Without proactive bias audits, marginalized groups may experience financial exclusion, but implementing real-time monitoring mechanisms and algorithmic explainability reduces these risks, ensuring fairness and regulatory compliance (Flavián et al., 2022). Additionally, interactive AI explanations, such as user-friendly visualizations and personalized risk assessments, help bridge knowledge gaps, making AI-driven financial recommendations more accessible to a broader audience (Zhu et al., 2023).

Given the challenges of evolving regulations and user skepticism, a hybrid human-AI oversight model is essential. Regulatory bodies, including the European Union's AI Act, emphasize the need for AI transparency and accountability in financial services (Montagnani et al., 2024). However, generative AI's ability to evolve post-deployment complicates regulatory compliance. Hybrid oversight, where financial professionals validate AI-driven recommendations, mitigates these risks by ensuring regulatory adaptability and enhancing user confidence (Pelster & Val, 2024). Additionally, studies show that users are more likely to trust AI-generated advice when they know it undergoes human review (Baek & Kim, 2023), reducing algorithm aversion and increasing adoption rates.

Finally, because the financial sector is highly sensitive to cybersecurity threats, enhancing transparency and data governance is critical for addressing regulatory risks and data security concerns, and AI-driven advisory platforms must implement strong encryption measures and dynamic privacy frameworks to protect user data (Pathak & Bansal, 2024). Inadequate safeguards can lead to breaches, damaging trust and inviting stricter regulatory scrutiny. Establishing governance structures, including periodic bias audits and ethical AI assessments, ensures compliance with evolving legal standards while maintaining platform integrity (Khan et al., 2025). Furthermore, integrating AI licensing frameworks, such as AIRAL, can standardize security protocols and enforce ethical accountability (Kofman, 2024).

Through the implementation of these strategies, robo-advisory systems can maximize the potential of AI while ensuring regulatory compliance, mitigating ethical risk, and fostering long-term user trust. The combination of XAI for transparency, human-AI collaboration for oversight, adaptive regulatory alignment, and strong data governance mechanisms provides a scientifically grounded framework for secure and equitable AI-driven financial services.

The integration of generative AI into robo-advisory systems presents a multidisciplinary challenge that spans technological advancements, ethical considerations, regulatory constraints, and psychological factors affecting user adoption, and a systematic literature review has revealed commonalities in existing research regarding AI's ability to enhance portfolio optimization and financial decision support while simultaneously highlighting diverging perspectives on transparency, compliance, and psychological trust issues. The majority of the reviewed studies agree that generative AI enhances financial advisory services by synthesizing structured and unstructured data sources, such as real-time news and social media sentiment analysis, thereby improving predictive accuracy (Romanenko et al., 2023; Ko & Lee, 2024). Generative AI models, especially those employing dynamic market simulations and real-time API integrations, significantly outperform traditional robo-advisory algorithms in risk assessment and adaptive decision-making (Oehler & Horn, 2024; Weber et al., 2024).

However, while these studies emphasize AI's analytical superiority, they diverge on the issue of transparency, and while some argue that XAI mechanisms can address black-box concerns (Flavián et al., 2022; Zhu et al., 2024), others warn that existing XAI approaches remain insufficiently interpretable for users with low financial literacy (Montagnani et al., 2024). This raises the question of whether increasing model interpretability at the cost of complexity reduction may result in a trade-off between user trust and analytical depth—a challenge that requires further research.

A central theme in the literature is otherwise the role of human oversight in AI-driven financial decision-making. Hybrid models, which combine AI-driven recommendations with human verification, are widely recognized as a mechanism for reducing algorithmic bias and overreliance on historical data (Karataş & Cutright, 2023; Pelster & Val, 2024). Research suggests that AI–human collaboration fosters trust, particularly when financial advisors clarify AI-generated insights through explainable decision-making frameworks (Zhu et al., 2023). However, studies diverge regarding the effectiveness of anthropomorphic AI features (e.g., conversational avatars or empathetic interfaces). While some authors argue that such features improve user engagement by reducing skepticism toward algorithmic decisions (Baek & Kim, 2023), other research warns that anthropomorphism without underlying transparency mechanisms may create superficial trust that erodes under real-world performance fluctuations (Walter et al., 2022). This indicates a need for holistic hybrid models that integrate human review, XAI, and culturally adaptive financial education tools to balance efficiency, fairness, and psychological acceptance. The review highlights two primary ethical risks associated with AI-driven robo-advisory systems:

1. Bias embedded in training data, leading to potential financial discrimination (Kofman, 2024; Gómez-Martínez & Medrano-Garcia, 2025), and;

2. Privacy and security vulnerabilities, particularly in the financial sector, where AI-driven systems process sensitive personal data (Pathak & Bansal, 2024).

While most studies advocate for continuous bias audits and fairness-enhancing mechanisms, the literature diverges on the best regulatory approach to mitigate these risks. The EU AI Act promotes strict compliance mechanisms and mandatory explainability standards, whereas the United States and Asia–Pacific regions adopt self-regulation models with industry-specific oversight (Montagnani et al., 2024; Niszczota & Abbas, 2023). This disparity suggests that cross-border harmonization of AI governance frameworks remains a critical challenge for global financial markets.

Moreover, proposals such as AIRAL emphasize structured AI certification and ethical scorecards, yet the feasibility of such frameworks remains debated. Critics argue that standardized AI regulations may slow innovation and impose high compliance costs, particularly for fintech startups (Khan et al., 2025). Further research is needed to evaluate the long-term economic trade-offs of AI regulatory harmonization.

The psychological dimension of AI adoption thus remains a contentious topic in the literature. While some studies suggest that XAI and hybrid human-AI models alleviate user mistrust (Ashrafi & Kabir, 2023; Ullah et al., 2024), others indicate that algorithm aversion persists even when transparency mechanisms are implemented (Baek & Kim, 2023). A key finding is that financial literacy moderates AI adoption rates:

1. Users with greater financial literacy are more likely to trust and critically evaluate AI-generated financial advice (Roh et al., 2023).
2. Users with lower financial literacy tend to overrely on AI without assessing its outputs, making them more vulnerable to algorithmic biases and misleading recommendations (Fatima & Chakraborty, 2024).

This discrepancy suggests that AI-driven robo-advisory systems must incorporate interactive financial education tools, such as what-if simulations and explainable risk assessments, to bridge cognitive gaps and promote responsible AI adoption.

4. Conclusion

This study explores how generative AI models, such as ChatGPT, can be integrated into robo-advisory systems to enhance portfolio optimization, decision support, and user engagement while remaining ethically and legally sound. A systematic literature review revealed that generative AI offers significant benefits for portfolio optimization, risk assessment, and market sentiment analysis by processing diverse data sources in real time. These capabilities can lead to more accurate and adaptive financial recommendations, especially when AI systems incorporate culturally adaptable interfaces to align with local market conditions and user preferences. Despite these advantages, the review underscores several critical challenges:

1. Ethical and Bias Concerns: Historical training datasets can introduce unintentional discrimination, particularly affecting marginalized groups. Continuous bias monitoring and model recalibration, together with XAI, are consistently highlighted as essential measures to ensure fairness and accountability.
2. Regulatory Complexity: The dynamic nature of AI evolution outpaces current legal frameworks, with regulations varying significantly across regions. Proposed solutions, such as AIRAL and adherence to the EU AI Act, provide structured compliance avenues but may also slow innovation due to high compliance costs.
3. Psychological and Behavioral Factors: Algorithm aversion and mistrust in opaque AI processes remain significant hurdles to user adoption. Studies show that users, particularly those with lower financial literacy, either mistrust AI decisions or overrely on them. User-centric onboarding, transparent design, and educational tools can help alleviate these barriers.

Addressing the research question—how to integrate generative AI ethically, within regulatory frameworks, and with attention to psychological user factors—requires a multidimensional strategy.

1. Transparency must be integrated into core system design, and XAI mechanisms must be used to clarify how AI arrives at specific recommendations.
2. Human oversight in the form of hybrid models adds an additional layer of trust and risk mitigation, ensuring accountability in high-stakes financial settings.
3. Culturally adaptable interfaces can broaden adoption by accommodating diverse user needs and local compliance requirements, especially in emerging markets.

In conclusion, generative AI has the potential to revolutionize robo-advisory services through real-time, data-driven insights that improve investment outcomes. However, realizing these gains demands a careful balance between technological innovation, regulatory alignment, ethical practices, and user psychology. Future research should focus on empirical evaluations of hybrid AI–human advisory models, cross-border regulatory harmonization, and the development of personalized financial education tools that promote both trust and informed engagement with AI-driven recommendations.

Ethical Considerations

Not applicable.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Funding

This research did not receive any financial support.

References

Adeyelu, O. O., Ugochukwu, C. E., & Shonibare, M. (2024). Ethical implications of AI in financial decision-making: A review with real-world applications. International Journal of Applied Research in Social Sciences, 6(4), 608–630. https://doi.org/10.51594/ijarss.v6i4.1033

Ashrafi, D. M. (2023). Managing consumer's adoption of artificial intelligence-based financial robo-advisory services: A moderated mediation model. Journal of Indonesian Economy and Business, 38(3), 270–301. https://doi.org/10.22146/jieb.v38i3.6242

Ashrafi, D. M., & Kabir, M. R. (2023). Human or AI? Understanding the key drivers of customers' adoption of financial robo-advisory services: The role of innovation resilience. Journal of Global Business and Technology, 19(1), 18–40.

Baek, T. H., & Kim, M. (2023). AI robo-advisor anthropomorphism: The impact of anthropomorphic appeals and regulatory focus on investment behaviors. Journal of Business Research, 64(1), 114039. https://doi.org/10.1016/j.jbusres.2023.114039

Cao, S., Jiang, W., Wang, J., & Yang, B. (2024). From man vs. machine to man + machine: The art and AI of stock analyses. Journal of Financial Economics, 160, 103910. https://doi.org/10.1016/j.jfineco.2024.103910

Crisanto, J. C., Leuterio, C. B., Prenio, J., & Yong, J. (2024). Regulating AI in the financial sector: Recent developments and main challenges. Financial Stability Institute (FSI) of the Bank for International Settlements (BIS). https://www.bis.org/fsi/publ/insights63.pdf

Dwork, C., & Minow, M. (2022). Distrust of artificial intelligence: Sources & responses from computer science & law. Daedalus, 151(2), 309–321. https://doi.org/10.1162/daed_a_01918

Fatima, S., & Chakraborty, M. (2024). Adoption of artificial intelligence in financial services: The case of robo-advisory in India. IIMB Management Review, 36(2), 113–125. https://doi.org/10.1016/j.iimb.2024.04.002

Flavián, C., Perez-Rueda, A., Belanche, D., & Casaló, L. (2022). Intention to use analytical artificial intelligence in services: The effect of technology readiness and awareness. Journal of Service Management, 33(2), 293–320. https://doi.org/10.1108/JOSM-10-2020-0378

Gómez-Martínez, R., & Medrano-Garcia, M. L. (2025). AI technology for developing Bitcoin investment strategies based on altcoin trends. Sustainable Technology and Entrepreneurship, 4(1), 100087. https://doi.org/10.1016/j.stae.2024.100087

Jung, D., Glaser, F., & Köpplin, W. (2019). Robo-advisory: Opportunities and risks for the future of financial advisory. In V. Nissen (Ed.), *Advances in Consulting Research* (pp. 405–427). Springer.

Karataş, M., & Cutright, K. M. (2023). Thinking about God increases acceptance of artificial intelligence in decision-making. *Psychological and Cognitive Sciences, 120*(33), e2218961120. https://doi.org/10.1073/pnas.2218961120

Khan, F., Bartáková, G. P., Almadhor, A., Qayyum, A., Abeer, K., & Durrani, A. (2025). Evaluating the capacity and limitations of generative AI in financial decision making. *Computer Standards & Interfaces, 93,* 103965. https://doi.org/10.1016/j.csi.2024.103965

Ko, H., & Lee, J. (2024). Can ChatGPT improve investment decisions? From a portfolio management perspective. *Finance Research Letters, 64,* 105433. https://doi.org/10.1016/j.frl.2024.105433

Kofman, P. (2024). Scoring the ethics of AI robo-advice: Why we need gateways and ratings. *Journal of Business Ethics, 198*(1), 21–33. https://doi.org/10.1007/s10551-024-05753-5

Lee, D. K. C., Guan, C., Yu, Y., & Ding, Q. (2024). A comprehensive review of generative AI in finance. *FinTech, 3*(3), 460–478. https://doi.org/10.3390/fintech3030025

Maier, T., Menold, J., Menold, J., & McComb, C. (2022). The relationship between performance and trust in AI in e-finance. *Frontiers in Artificial Intelligence, 5,* 891529. https://doi.org/10.3389/frai.2022.891529

Manrai, R., & Gupta, K. P. (2023). Investor's perceptions on artificial intelligence (AI) technology adoption in investment services in India. *Journal of Financial Services Marketing, 28*(1), 1–14. https://doi.org/10.1057/s41264-021-00134-9

Montagnani, M. L., Najjar, M.-C., & Davola, A. (2024). The EU regulatory approach(es) to AI liability, and its application to the financial services market. *Computer Law & Security Review, 53,* 105984. https://doi.org/10.1016/j.clsr.2024.105984

Niszczota, P., & Abbas, S. (2023). GPT has become financially literate: Insights from financial literacy tests of GPT and a preliminary test of how people use it as a source of advice. *Finance Research Letters, 58*(A), 104333. https://doi.org/10.1016/j.frl.2023.104333

Oehler, A., & Horn, M. (2024). Does ChatGPT provide better advice than robo-advisors? *Finance Research Letters, 60,* 104898. https://doi.org/10.1016/j.frl.2023.104898

Pathak, A., & Bansal, V. (2024). AI as decision aid or delegated agent: The effects of trust dimensions on the adoption of AI digital agents. *Computers in Human Behavior: Artificial Humans, 2*(2), 100094. https://doi.org/10.1016/j.chbah.2024.100094

Pelster, M., & Val, J. (2024). Can ChatGPT assist in picking stocks? *Finance Research Letters, 59*(1), 104786. https://doi.org/10.1016/j.frl.2023.104786

Pisoni, G., & Díaz-Rodríguez, N. (2023). Responsible and human-centric AI-based insurance advisors. *Information Processing and Management, 60*(3), 103273. https://doi.org/10.1016/j.ipm.2023.103273

Roh, T., Park, B. I., & Xiao, S. (2023). Adoption of AI-enabled robo-advisors in fintech: Simultaneous employment of UTAUT and the theory of reasoned action. *Journal of Electronic Commerce Research, 24*(1), 29–47.

Romanenko, O., Narayan, A., & Kwon, R. H. (2023). ChatGPT-based investment portfolio selection. *Operations Research Forum, 4*(4), 91. https://doi.org/10.1007/s43069-023-00277-6

Singh, S., & Kumar, A. (2025). Investing in the future: an integrated model for analysing user attitudes towards Robo-advisory services with AI integration. *Vilakshan-XIMB Journal of Management, 22*(1), 158-175. https://doi.org/10.1108/XJM-03-2024-0046

Statista GmbH. (2024). Robo-Advisors - Worldwide. *Statista GmbH.* https://www.statista.com/outlook/fmo/wealth-management/digital-investment/robo-advisors/worldwide

Ullah, R., Ismail, H. B., Khan, M. T., & Zeb, A. (2024). Nexus between Chat GPT usage dimensions and investment decision making in Pakistan: Moderating role of financial literacy. *Technology in Society, 76*(4), 102454. https://doi.org/10.1016/j.techsoc.2024.102454

vom Brocke, J. S. (2009). Reconstructing the giant: On the importance of rigour in documenting the literature search process. In *Proceedings of the 17th European Conference on Information Systems (ECIS 2009)* (pp. 2206–2217). Verona, Italy.

Walter, B. v., Kremmel, D., & Jäger, B. (2022). The impact of lay beliefs about AI on adoption of algorithmic advice. *Marketing Letters, 33*(1), 143–155. https://doi.org/10.1007/s11002-021-09589-1

Wang, Y. (2024). Ethical considerations of AI in financial decision. *Computing and Artificial Intelligence, 2*(1), 1290. https://doi.org/10.59400/cai.v2i1.1290

Weber, P., Carl, K. V., & Hinz, O. (2024). Applications of explainable artificial intelligence in finance—a systematic review of finance, information systems, and computer science literature. *Management Review Quarterly, 74*(2), 867–907. https://doi.org/10.1007/s11301-023-00320-0

Zheng, X., Li, J., Lu, M., & Wang, F. Y. (2024). New paradigm for economic and financial research with generative AI: Impact and perspective. *IEEE Transactions on Computational Social Systems, 11*(3), 3457–3467. https://doi.org/10.1109/TCSS.2023.3334306

Zhu, H., Pysander, E.-L. S., & Söderberg, I.-L. (2023). Not transparent and incomprehensible: A qualitative user study of an AI-empowered financial advisory system. *Data and Information Management, 7*(3), 100041. https://doi.org/10.1016/j.dim.2023.100041

Zhu, H., Vigren, O., & Söderberg, I.-L. (2024). Implementing artificial intelligence empowered financial advisory services: A literature review and critical research agenda. *Journal of Business Research, 174,* 114494. https://doi.org/10.1016/j.jbusres.2023.114494