

ARTICLES

ACCOUNTABILITY MECHANISMS AND
THE REGULATORY FRAMEWORK FOR
AI FINANCIAL ADVISORS*Zhao Jingchen*

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A regulatory framework is proposed to address the expanding role of artificial intelligence (AI) in financial advisory services, prioritizing accountability mechanisms for robo-advisors and defining human responsibility. Central to the framework is resolving the AI ‘black box’ challenge—opaque algorithmic processes that risk generating unintended outcomes due to insufficient human oversight or interpretability. Current practices, efficacy, and risks within the fintech robo-advisory sector are systematically evaluated, followed by the design of a governance model to strengthen accountability for AI-driven tools. Hybrid advisory systems combining automation with human supervision are advocated to reduce algorithmic aversion, ensuring personalized, adaptable, and ethically governed financial services.

I. INTRODUCTION

In a financial service setting, artificial intelligence (AI) is defined as the use of computers to assist, support, collaborate or even duplicate traditional human financial advisors’ behaviours and services, and refers to the effects generated by the realization of human minds through computers. Robo-advisors are online-based advisory services that use algorithms and AI to create investment recommendations. They are growing in popularity, largely because of their ability to deliver financial advice at a fraction of the cost of traditional financial advisors.¹ They use AI to automatically make investment decisions or carry out tasks that are usually done by human advisors. While AI ‘remains an unclear term with no settled technical or legal meaning’,² its use can potentially transform companies’ strategic operations across many sectors of the global economy. As the speed of AI innovation

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1 Philipp Maume, *Regulating Robo-Advisory*, 55 Texas International Law Journal 49 (2019).

2 KIMBERLEE WEATHERALL & TIBERIO CATANO, SUBMISSION IN RESPONSE TO AUSTRALIAN HUMAN RIGHTS COMMISSION DISCUSSION PAPER, HUMAN RIGHTS AND TECHNOLOGY, at <https://classic.austlii.edu.au/au/journals/USydLRS/2020/10.pdf> (Last visited on March 6, 2025).

and data-driven business transformation accelerates, investors, depositors and stakeholders in the financial system need to grasp how these technologies may impact their investment practices and the potential risks involved.

By using improved datasets and algorithms to deliver efficient solutions tailored to people's needs, AI applications can be deployed to help people to save, invest and retire better. One of the most up-to-date trends to emerge in this area in recent years is the use of robo-advisors, who manage 'portfolios' based on individual investment plans and priorities based on advice and options provided by technology such as algorithms, big data analysis and AI.³ Using information provided by customers, the algorithms linked with the robo-advisor select the right portfolios for each client. Robo-advisors were initially introduced around 2007-2008 as an approach for individual investors to manage their financial affairs economically, instead of by going through the traditional human financial advisor.⁴

The benefits brought by AI and robo-advisors follow similar curves. PwC research suggests that global GDP could be up to 14% higher in 2030 due to the use of AI applications, contributing an additional 15.7 trillion US dollars.⁵ AI represents the biggest commercial opportunity in the fast-changing global economy. The number of users of robo-advisors in China is expected to amount to 0.024 million by 2029,⁶ representing a new trend in the investment advisory and wealth management industries. Fintech has built innovative business models and investment mechanisms, and facilitates opportunities for the participation and growth of robo-advisors. It is expected that assets under the management of robo-advisors in China are projected to reach 3.14 billion US dollars in 2025, with an annual growth rate of 4.92% resulting in a projected total amount of 3.81 billion US dollars by 2029.⁷

Robo-advisors are defined by different sources with different focuses. In general, though, they are automated advisors offering automated or algorithm-driven financial planning services through digital platforms.⁸

3 KEUN YOUNG LEE, HUN YEONG KWON & JONG IN LIM, LEGAL CONSIDERATION ON THE USE OF ARTIFICIAL INTELLIGENCE TECHNOLOGY AND SELF-REGULATION IN FINANCIAL SECTOR: FOCUSED ON ROBO-ADVISORS, in INFORMATION SECURITY APPLICATIONS, at 325 (Springer International Publishing AG, 2018).

4 Gordon Kuo Siong Tan, *Robo-Advisors and the Financialization of Lay Investors*, 117 *Geoforum* 46 (2020).

5 ANAND S. RAO & GERARD VERWEIJ, SIZING THE PRIZE: WHAT IS THE REAL VALUE OF AI FOR YOUR BUSINESS AND HOW CAN YOU CAPITALISE?, at <https://www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html> (Last visited on March 6, 2025).

6 ROBO-ADVISORS: CHINA, at <https://www.statista.com/outlook/fmo/wealth-management/digital-investment/robo-advisors/china> (Last visited on March 5, 2025).

7 *Id.*

8 JOTHAM LIM, ROBO-ADVISORY PLATFORMS: ROAD BUMPS AND SILVER LININGS, at <https://www.theedgemarkets.com/article/roboadvisors-roboadvisory-platforms-road-bumps-and-silver-linings#:~:text=Robo%2Dadvisors%20are%20defined%20as,and%20passively%20managed%20mutual%20funds> (Last visited on March 5, 2025).

They use innovative technologies to deliver asset management services to investors through online algorithm-based programmes.⁹ These automated financial advisory platforms encompass interactive and intelligent financial guidance by minimizing costs and avoiding conflicts of interest. In recent years, robo-advisors have substantially changed the effectiveness and channels of financial services delivery. The ‘Digital Finance Strategy’ for the EU describes the role of digitalization in the future of finance,¹⁰ while digital finance also facilitates customer-friendly financial services. Both financial institutions and their stakeholders have progressively depended on remote technologies such as AI and new collaboration and communication tools.

A huge amount of academic literature has examined the viability and effectiveness of different forms of robo-advice. However, issues around the accountability of these advisors have rarely been discussed. This is partly due to the lack of legal personalities for robots when giving financial advice. Therefore, it is key to articulating the nature and scope of ethical and legal standards for robo-advisors. It is also worth investigating whether the advice currently provided is appropriate for all potential investors, and how to offer suitable guidance when AI generates recommendations outside the expertise of law enforcement agencies or legal practitioners.

This article aims to address the challenges and risks involved with the use of robo-advisors in the fintech industry, and propose the most feasible regulatory approaches to tackle them. It is hoped that the proposed regulatory approaches will require financial institutions to assess the impacts of the robo-advisors they use, create new transparency about when and how automated systems are used, and empower investors, particularly vulnerable investors, to make informed decisions about the automation of critical decisions. If these challenges are resolved, robo-advisors can provide customers with an accessible, cost-effective and accountable service. The article investigates the effectiveness of robo-advisors and their regulation through innovative lenses such as vulnerability and fiduciary duties.

This is a significant attempt with broad-spectrum relevance to the reconciliation of the interests of investors and the regulation of more accountable robo-advisors, and it will make a long-lasting contribution to vulnerable investors’ engagement, economic well-being, accountable technology and social cohesion. In detail, the significance of the article rests on the following two aspects. First, the analysis hopes to support

9 ROBO-ADVISORS, GUIDANCE UPDATE NO. 2017-02, at <https://www.sec.gov/investment/im-guidance-2017-02.pdf> (Last visited on March 5, 2025).

10 European Commission, *Digital Finance Strategy for the EU*, COM (2020) 591 final 1, 4, 17.

insiders in fintech companies to better understand the rationale, importance, and possible approaches to providing accountable services and protecting vulnerable investment communities. Second, the links between accountable robo-advisors and financial duties, vulnerable investors, transparency and law enforcement will support policymakers to design additional legislative approaches more confidently, thereby reducing the risk of irresponsible financial services provided by AI.

The article proceeds as follows. Section II is concerned with the current practice and challenges of investment robo-advisors, while section III critically reviews the nature and scope of more accountable robo-advisors. Section IV looks at the links between the regulation of robo-advisors with transparency, the vulnerability and protection of unsophisticated investors and the fiduciary duties of robo-advisors, in order to shed light on the legitimacy and accountability of robo-advisors and the importance of regulation to maintain just and trustworthy AI and mitigate the vulnerability of uninformed and disadvantaged investors. Finally, there will be some concluding remarks.

II. CURRENT PRACTICE AND CHALLENGES OF INVESTMENT ROBO-ADVISORS

The use of AI is now prevalent in the public and commercial sectors and many other spheres of human endeavour. In the commercial and financial sphere, it provides sophisticated analytics and performs a range of functions formerly undertaken by human employees. The use of robo-advisory is a process of providing financial investment services based on algorithms, which are designed to function with or without a low level of human intervention. Robo-advisory has also been described as ‘automated financial advice’ or ‘digitized advice’.¹¹ In order to address the challenges brought by human financial advice, such as cost and interest-based biases, robo-advisors have witnessed rapid growth over the last decade, and have become an important alternative to conventional human advisors.¹² They have also helped investors to close the ‘financial advice gap’.¹³

Robo-advisors rely heavily on software-based advice and need a different

11 Philipp Maume, *supra* note 1, 61.

12 Humoud Alsabah, Agostino Capponi & Octavio Ruiz Lacedelli et al., *Robo-Advising: Learning Investors’ Risk Preferences via Portfolio Choices*, 19 *Journal of Financial Economics* 369 (2021).

13 FINANCIAL CONDUCT AUTHORITY, FINANCIAL ADVICE MARKET REVIEW: FINAL REPORT 2016, at <https://www.fca.org.uk/publication/corporate/famr-final-report.pdf> (Last visited on March 5, 2025).

approach to regulation. In order to make robo-advisors workable for and accountable to investors, it is important to create a regulatory environment that gives financial institutions the clarity they need to compete and innovate as they work to fill this gap. Such an optimal regulatory environment and model will be key to resolving inconsistencies in the current legal framework.

Investors watching out for low-cost automated wealth management services are particularly keen to invest through these platforms. Robo-advisors in the fintech industry are automated digital investment advisors, offering individual portfolio management services to customers. They are part of the fintech that is restructuring the wealth management industry. Although it is relatively new, this innovative solution has grown significantly over recent years, and is being used to achieve a good balance between promoting innovation and protecting investors.¹⁴ It will also help to develop investors' confidence, and ultimately reinforce their market participation.

Compared with traditional investment advisors, robo-advisors are a financial innovation that gives retail investors access to cheaper and more convenient financial management. Employing built-in algorithmic procedures, robo-advisors supervise and balance investors' portfolios efficiently but with low costs. Traditionally, these costs include the salaries of financial advisors and the maintenance of physical offices, lowering investment thresholds to a minimum. Also, robo-advisors facilitate more transparent and systematic advice supported by big data, mitigating the biases that may be generated by human advisors.¹⁵ Robo-advisors are less subject to conflict of interest as their fees will not depend on their management or rebalancing positions.¹⁶ Financial services through AI can also be extended at a reduced residual cost, and the analysis of portfolios and the assessment of risk asset reallocations can be completed in milliseconds. Other advantages for investors are the multitude of automatic dynamic account balancing services, such as moving money out of the market and keeping it in cash during a severe downturn, or tax-loss harvesting strategies consisting of offsetting losses from one kind of security with gains from another.

Robo-advisors are one of the new solutions in the wealth management industry. Following the global financial crisis in 2008, investors changed their investment preferences from expensive mutual funds to passive investing

14 Robin Hui Huang, Charles Chao Wang & Olivia Xin Zhang, *The Development and Regulation of Robo-Advisors in Hong Kong: Empirical and Comparative Perspectives*, 22 *Journal of Corporate Law Studies* 229 (2022).

15 Stephen Foerster, Juhani T. Linnainmaa & Brian T. Melzer et al., *Retail Financial Advice: Does One Size Fit All?*, 72 *The Journal of Finance* 1441 (2017).

16 Mariano Méndez-Suárez, Francisco García-Fernández & Fernando Gallardo, *Artificial Intelligence Modelling Framework for Financial Automated Advising in the Copper Market*, 5 *Journal of Open Innovation: Technology, Market, and Complexity* 81 (2019).

in exchange-traded funds. Since the financial crisis, fintech, including robo-advisors, has offered an innovative opportunity for data-driven finance. Recently, big corporations have recaptured their market share in active stock-picking securities by employing robo-advisors, reorganizing their investment advising branches and creating new business models.¹⁷ Empirical investigation has demonstrated the beneficial effects of a robo-advising platform, particularly in relation to investors' performance and trading behaviour,¹⁸ and it has been concluded that robo-advisors tend to pick optimal portfolios for investors, while investors should have the option to either accept or override the AI's decisions.¹⁹ The adoption of robo-advising increases portfolio diversification, displays higher performance with regard to market-adjusted trade returns and market-adjusted portfolio returns, and reduces behavioural biases such as the disposition effect, trend-chasing and the rank effect.

Another advantage of robo-advisors is their ability to provide straightforward and accessible alternatives to low-interest savings accounts offered by financial institutions. These automated platforms can minimize research time and eliminate unnecessary bias and emotions; they are investment instruments designed for passive and long-term investors.²⁰ Assets under management in the worldwide robo-advisory segment are projected to reach 2.06 trillion US dollars in 2025, and the trajectory of assets under management of robo-advisors is expected to show an annual growth rate of 3.66% resulting in a projected total amount of 2.38 trillion US dollars by 2029.²¹

An increasing number of fintech institutions manage 'portfolios' based on individual investment trends using technology such as algorithms, big data analysis and AI.²² The services provided by robo-advisors follow a workflow composed of five main steps: universal pre-selection of ETF, investor profile identification, portfolio optimization, portfolio rebalancing and monitoring, and portfolio performance review and reporting.²³ These robo-advisors managed three main categories of portfolios, including pension

17 *Id.*

18 Francesco D'Acunto, Nagpurnanand Prabhala & Alberto G Rossi, *The Promises and Pitfalls of Robo-Advising*, 32 *The Review of Financial Studies* 2004-2006 (2019).

19 *Id.*

20 Kan Jie Marcus Ho & Ma Chao Jun, *Robo-Advisors: A Comparative Analysis in the Context of Fiduciary Law*, 5 *De Lege Ferenda* 20 (2022).

21 ROBO-ADVISORS: WORLDWIDE, at <https://www.statista.com/outlook/fmo/wealth-management/digital-investment/robo-advisors/worldwide?currency=USD> (Last visited on March 6, 2025).

22 Jeremy Barnett & Adriano Koshiyama, *Algorithms: Law and Regulation*, 52 *Computer* 34 (2019).

23 Mikhail Beketov, Kevin Lehmann & Manuel Wittke, *Robo Advisors: Quantitative Methods Inside the Robots*, 19 *Journal of Asset Management* 365-366 (2018).

accounts, individual savings accounts, and general investment accounts. Moreover, compared to human financial advisors, the management costs are much lower. Some platforms offer financial portfolio development and management tools, tax-efficient techniques, or socially responsible portfolios. These AI-managed portfolios typically aim to build wealth gradually, with the robo-advisor making this more convenient through automated portfolio management processes.

In the process of advice provision for selecting financial products, customers invest their cash in the portfolios recommended to them by the robo-advisor's algorithm. Most UK robo-advisors have an assigned range of portfolios created to fit different investors' risk tolerance. Historically, advanced technology became increasingly available to the general public from 2008 onwards, with robo-advisors using the modern portfolio theory and rebalancing bands to index users' portfolios.²⁴ The application of robo-advisors is consistent with market dynamics to ensure optimal class weightings, and informed investment decisions are achieved through the algorithms.

The number of robo-advisors is steadily increasing, and the services they offer are becoming complicated and diverse. In the UK, Nutmeg, founded in 2011 and offering a novel approach to investing, is now the biggest and the oldest robo-advisor available for investors, with over 4.5 billion pounds in assets under management and 200,000 clients. Nutmeg recommends exchange-traded fund portfolios customized to customers' profiles through online questionnaires. Customers then choose their portfolio based on different levels of risk. Financial institutions such as Nutmeg, Moneyfarm and Clim8 use technology to sustain their low-cost and clear service.

Despite the benefits brought by robo-advisors, such as greater simplicity and efficiency in implementing strategies, they may also take a narrow and irresponsible view of investments or financial situations. Robo-advisory tools might be subject to the biases, conflicts and limitations of the humans and institutions that develop them. This is particularly relevant considering the low returns from financial products with fixed interest. When they are appointed, one of the most salient problems related to investment robo-advisors is how to ensure they invest in an accountable manner. As the advisory service may lack healthy communication with human advisors, it is sometimes necessary to appoint fiduciaries and accountors, so as to impose a legal obligation to act in the client's best interests and make them liable for misconduct and negligence. This is key in promoting the formation of

24 Seungho Baek, Kwan Yong Lee & Merih Uctum et al., *Robo-Advisors: Machine Learning in Trend-Following ETF Investments*, 16 Sustainability 6399 (2020).

healthy investor subjects by reducing risk and eliminating bias, reaffirming the importance of accountable robo-advisors.

III. THE NATURE AND SCOPE OF MORE ACCOUNTABLE ROBO-ADVISORS

Despite its significance, accountability in AI is often defined imprecisely, with undifferentiated references to the values, practices and measures it encompasses.²⁵ The *EU Ethics Guidelines for Trustworthy AI 2019* (hereinafter referred to as the EU ethics guidelines) have promoted the development of accountability in algorithms. Due to its broad societal impact, the accountability of AI should be investigated through a socio-technical lens. The EU ethics guidelines emphasize that AI should be accountable for its decisions both before and after its development, deployment and use. The application of AI without due processes and governance frameworks can cause massive damage, ranging from engendering inequality and disadvantaging the vulnerable and minorities to weakening the basic fabric of society. These undesirable concomitants also remind us of the significance of accountable decisions when AI technologies offer financial advice to inform human investors' decisions. Moreover, the incentives to apply AI technology in the context of profit-making also highlight the legislative necessity of regulating AI along an accountable and sustainable trajectory.

There are many kinds of accountability — moral, social, administrative, managerial, market, legal and professional²⁶ — but AI systems and the application of AI in the fintech intersect with all of them.²⁷ In corporate settings with the involvement of AI, process accountability is just as important as outcome accountability to ensure AI is applied responsibly and ethically. This includes data collection, algorithm design and providing strategic options, especially in critical applications. The various users and stakeholders of AI systems may indicate the focus of the accountability framework during the development of the system based on the power they hold in the decision-making process. Explainable AI promotes the understandability of models established by AI and black box algorithms, and

25 Claudio Novelli, Mariarosaria Taddeo & Luciano Floridi, 'Accountability in Artificial Intelligence: What It Is and How It Works', 39 AI & SOCIETY 1871-1882 (2024).

26 Mark Bovens, *Analysing and Assessing Accountability: A Conceptual Framework*, 13 European Law Journal 447 (2007).

27 JOSHUA A. KROLL, ACCOUNTABILITY IN COMPUTER SYSTEMS, in THE OXFORD HANDBOOK OF ETHICS OF AI, at 181 (Oxford University Press, 2020).

is key to addressing public accountability considerations.²⁸

In the context of robo-advisors, accountability is the capability of AI to validate its own algorithmic decision-making. This study defines AI accountability as a process in which financial advisors have potential responsibilities to justify their financial decisions to investors, and are held liable for any impending positive or negative impact on investors' wealth. The insights of accountable robo-advisors and accountable AI lay a solid benchmark for a sustainable, efficient and trustworthy application of AI in financial sectors. An effective accountability mechanism will help robo-advisors provide services that align with their stakeholders' expectations, recognize potential risks and biases, and prescribe standards for evaluation and improvement. The unique risks that robo-advisors present to investors and financial systems indicate the need for new regulatory philosophies and approaches to regulate them.²⁹ Robo-advisors can also be a means to develop the quality of financial advice, since AI and algorithms can segment services to an extent that is beyond the reach of humans. Accountability can be understood as an obligation to clarify and rationalize AI's conduct. More accountable robo-advisors in the fintech industry are *de facto* a query related to accountable AI. One of the important obstructing aspects of adopting robo-advisors is the implications of the accountability of advice and outcomes influenced by an AI advisor. Accountable AI may be understood as a means to ensure the legitimate and sustainable performance of robo-advisors and the fintech institutional system at large.

In complicated business settings with the involvement of robo-advisors, AI system transparency is particularly important to ensure the accountability and responsibility of AI designers, investors, programmers and human advisors. Moreover, adequate and accessible redress should also be ensured. *Slota* and others note that accountable AI has become 'a matter of building systems that can be challenged, interrogated, and, most importantly, adjusted in use to accommodate counter-intuitive results and unpredictable impacts'.³⁰ Therefore, the accountability of robo-advisory services can be seen as a mechanism to deal with the risks and responsibilities attached to corporate actor-hood. Accountability may be approached as a specific social relation or mechanism that involves an obligation to explain and justify actors' conduct and decision-making processes.³¹

28 Madalina Busuioc, *Accountable Artificial Intelligence: Holding Algorithms to Account*, 81 Public Administration Review 825 (2020).

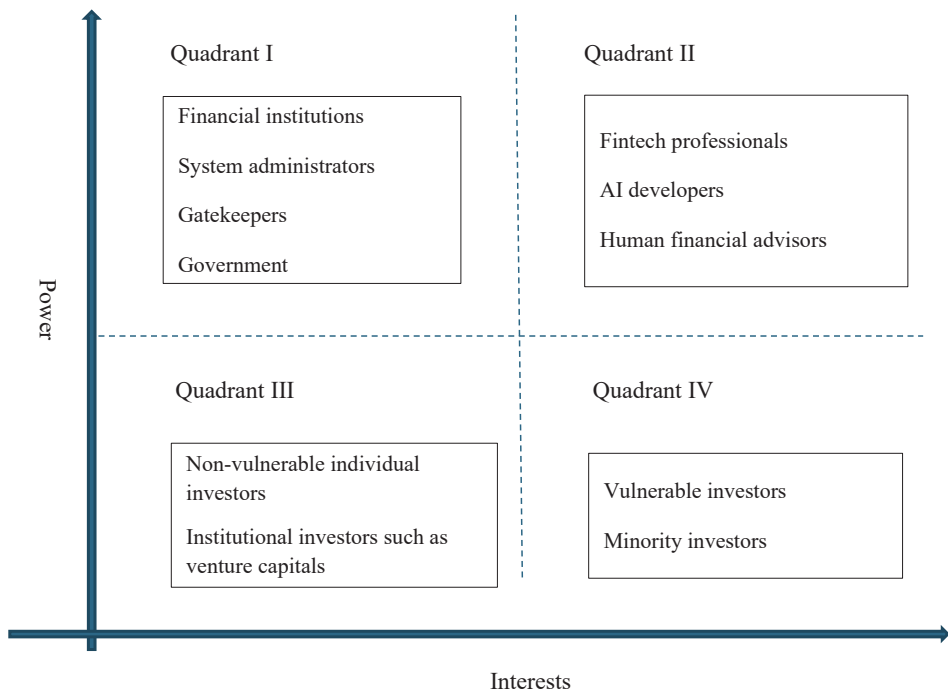
29 Robin Hui Huang, Charles Chao Wang & Olivia Xin Zhang, *supra* note 14.

30 Stephen C. Slota, Kenneth R. Fleischmann & Sherri Greenberg et al., *Many Hands Make Many Fingers to Point: Challenges in Creating Accountable AI*, 38 AI & SOCIETY 1287 (2023).

31 Mark Bovens, *Two Concepts of Accountability: Accountability as a Virtue and as a Mechanism*, 33 West European Politics 951 (2010).

Figure 1 shows various stakeholders in the power interest matrix. Naturally, fintech professionals and developers of robo-advisors are the people making critical decisions. The groups consist of AI developers, big data companies, human financial advisors, and other professionals directly involved in providing financial advice. AI developers of robo-advisors have the power to design, implement, use and programme AI. They directly control the AI application and development, and are important accountors when promoting more accountable AI. System administrators and gatekeepers decide the development of AI systems in the practice of developing robo-advisors. Although they might have less interest in how accountability is designed in the system, they may still have the power to approve or deny the use of AI in a professional environment.

Figure 1: Stakeholders in the Power Interest Matrix for Robo-Advisors



Vulnerable investors also have a lot at stake when using AI assistance tools. They usually lack financial advantages and are less sophisticated and informed. They have little financial knowledge, and often have a laid-back and hands-off investing style.³² They are highly interested in robo-advisors

32 Gordon Kuo Siong Tan, *supra* note 4, 48.

who are accountable in their decision-making processes. However, they have a limited influence on the application of robo-advisors, since their decisions primarily relate to whether to seek assistance from robo-advisors or not. Non-vulnerable investors, such as institutional investors, may be willing to try innovative ways to obtain financial advice without increasing the stakes or participating in the decision-making process related to robo-advisor application. Therefore, they will have relatively less interests and power in the accountability aspects of AI assistance tools in fintech systems. Compared with vulnerable investors, they normally have more information and bargaining power, and a better understanding of the fintech system and the importance of accountable and trustworthy robo-advisors. The accountability of robo-advisors is particularly relevant for vulnerable investors, since wealthy people with significant savings are attractive to conventional financial advisors in many jurisdictions.³³

IV. LEGISLATIVE SUGGESTIONS FOR MORE ACCOUNTABLE ROBO-ADVISORS

Law and regulation are often introduced in response to the emergence of new digital finance platforms in asset management. Robo-advice is the latest such platform, and it will be regulated as such.³⁴ Since this new digital finance platform merges financial guidance, asset allocation, execution of operations and portfolio management, it is valuable and crucial for us to evaluate whether the innovative nature of robo-advisors means that they require tailored regulation in view of their nature, scope, function and operational risks. Thus, legislative suggestions for more accountable robo-advisors must also cover a wide range of issues.

A. Algorithmic Transparency and Explainability

The purpose of transparency (publicity) is ‘a remedy for social and industrial diseases’, as ‘sunlight is said to be the best of disinfectants’.³⁵ The traditional functions of transparency include reducing information asymmetries and instilling confidence in the market.³⁶ Open, clear, interactive

33 Philipp Maume, *supra* note 1, 50.

34 Dirk A. Zetsche, William A. Birdthistle & Douglas W. Arner et al., *Digital Finance Platforms: Toward a New Regulatory Paradigm*, 23 University of Pennsylvania Journal of Business Law 339 (2020).

35 LOUIS D. BRANDEIS, *OTHER PEOPLE'S MONEY AND HOW THE BANKERS USE IT*, at 65 (Martino Fine Books, 2009).

36 GAËTANE SCHAEKEN WILLEMAERS, *THE EU ISSUER-DISCLOSURE REGIME: OBJECTIVES AND PROPOSALS FOR REFORM*, at 21 (Kluwer Law International, 2011).

and honest reporting will assist the company in building sustainable relationships with investors, gatekeepers and AI developers. As an essential element of the accountability approach, disclosure is designed to demonstrate corporate commitment, and to increase the public's understanding of the rationale behind using AI for financial services, especially since robo-advisors have been given tasks such as providing investment recommendations, executing investors' decisions or rebalancing financial portfolios to preserve the desired asset allocation based on customer characteristics.³⁷

The accountability process is divided into three phases, including: the accountors' obligation to respond to actions and decisions; the accountee's obligation to acquire information in relation to these actions and decisions; and finally, the accountee's judgement and assessment of the accountor,³⁸ which may result in punitive measures against the accountor.³⁸ In order to achieve these three stages, it is imperative for accountors to provide accurate information concerning their decisions and actions, so that investors can be informed about them. Accountability is an obligation on the accountor to inform about and justify their conduct to an accountee. A part of this is transparency, which involves information disclosure and being transparent concerning the work of the accountor. In this context, regulation is the most effective way to enforce order, consistency and standards. As with other legal issues surrounding the involvement of AI, black-box problems continue to plague the ways in which robo-advisors operate. The most feasible way to tackle this problem is to encourage the development of transparent, and therefore accountable, robo-advisors.

One of the advantages of robo-advisers is being transparent to the risks of being incentivised to maximize personal interests, which may be practised by human advisers and be in conflict with investors' best interests. Moreover, technological developments in AI have made algorithmic decisions in fintech increasingly complex and autonomous, which will interrupt system comprehensibility and user trust.³⁹ A potential channel to mitigate this loss of trust is to build a more transparent decision-making basis for financial service autonomous systems. Therefore, it is even more significant to examine the algorithms applied by robo-advisors in order to test their appropriateness and

37 Michael Faloon & Bernd Scherer, *Individualization of Robo-Advice*, 20 *The Journal of Wealth Management* 30 (2017).

38 MARK BOVENS, PUBLIC ACCOUNTABILITY, in *THE OXFORD HANDBOOK OF PUBLIC MANAGEMENT*, at 182 (Oxford University Press, 2005).

39 ALEXANDER RÜHR, BENEDIKT BERGER & THOMAS HESS, THE AMBIVALENT EFFECT OF TRANSPARENCY ON TRUST IN ROBO-ADVISORS: AN EXPERIMENTAL INVESTIGATION, at <https://aisel.aisnet.org/pacis2021/149/> (Last visited on March 15, 2025).

suitability for retail investors.

The black box problem makes it difficult to identify a single perpetrator for unaccountable decisions made by boards with the involvement of AI. In other words, ‘the decision-making inside the AI system is so complex that it is not possible to know why a particular outcome arose.’⁴⁰ The transparency of robo-advisors is closely linked to neighbouring concepts that are sometimes used as synonyms for transparency, including the explainability or understandability of AI in fintech, which involves a consideration of the non-arbitrariness of decisions.⁴¹ In the US, for example, Charles Schwab lacked transparency with regard to its fees and portfolio allocations, generating possible conflicts of interest.⁴² It was concluded by *David Goldstone*, Manager of Research and Analytics at Backend Benchmarking, that robo-advisors need to be transparent in terms of their decisions and the rationale for those decisions.⁴³ Transparency has always been seen as a contemporary, ethical, legal and social ‘ideal’,⁴⁴ a standardizing mandate for the ethical and sustainable application of technology in society. It reflects the ideal of ‘openness’, which may be encapsulated in the terms ‘open data, open source, open code and open access’ as well as ‘open science’.⁴⁵

In order to reflect this ideal in practice and improve investor protection through increased transparency of the black boxes related to robo-advisors, banks and wealth managers need to disclose the source code, inputs and outputs of their algorithms, as well as descriptions of and the evidence base and rationale of the algorithm. In order to pursue the accountability of robo-advisors, the transparency requirement may be related to issues such as investment logic, the intelligence level of investment, investment risks or the level of customization. Technical transparency will build trust with investors, and make future partnerships easier and more effective. One of the

40 Alan Dignam, *Artificial Intelligence: The Very Human Dangers of Dysfunctional Design and Autocratic Corporate Governance*, 314 Legal Studies Research Paper 18 (2019).

41 See Karen Elliott, Rob Price & Patricia Shaw et al., *Towards an Equitable Digital Society: Artificial Intelligence (AI) and Corporate Digital Responsibility (CDR)*, 58 Society 179 (2021); Mariano-Florentino Cuéllar, *A Common Law for the Age of Artificial Intelligence: Incremental Adjudication, Institutions, and Relational Non-Arbitrariness*, 119 Columbia Law Review 1773 (2019).

42 VICTOR CHATENAY, THE SEC WILL CALL FOR MORE TRANSPARENCY FROM ROBO-ADVISORS, at <https://www.insiderintelligence.com/content/sec-will-call-more-transparency-robo-advisors> (Last visited on March 15, 2025).

43 SCHWAB’S \$200M ROBO FINE RESERVE REVEALS BIG DISCLOSURE HOLE, at <https://www.thewealthadvisor.com/article/schwabs-200m-robo-fine-reserve-reveals-big-disclosure-hole> (Last visited on March 15, 2025).

44 See IDA KOIVISTO, THE ANATOMY OF TRANSPARENCY: THE CONCEPT AND ITS MULTIFARIOUS IMPLICATIONS, at https://cadmus.eui.eu/bitstream/handle/1814/41166/MWP_2016_09.pdf?sequence=1 (Last visited on March 15, 2025).

45 See BENEDIKT FECHER & SASCHA FRIESIKE, OPEN SCIENCE: ONE TERM, FIVE SCHOOLS OF THOUGHT IN OPENING SCIENCE: THE EVOLVING GUIDE ON HOW THE INTERNET IS CHANGING RESEARCH COLLABORATION AND SCHOLARLY PUBLISHING, at 26-32 (Springer Nature, 2014).

examples of desirable transparency is to make fee structures and breakdowns transparent, by making the rationale for service fees accessible and also by reporting the product fees of underlying mutual funds and cost for AI development, maintenance, management and research to ensure a competent robo-advisor service.

The information disclosure duty is another related duty, while fintech firms using robo-advisors are required to warn investors of any risks and disclose any defects of the product, as well as its functional limitations. A risk disclosure statement should be provided to clients to ensure that they are well informed of the risks of engaging in investments. Fair and clear disclosure would equip consumers with better information, enabling them to make more informed decisions on whether to utilize the benefits of robo-advice.

If it were to be made mandatory, such a stringent and standardized transparency approach would shift the burden of belief from the algorithm to the regulators.⁴⁶ This would offer a plausible solution in many arenas, particularly for vulnerable investors who do not fully understand financial markets. However, they could trust and rely on regulatory authorities such as the China Securities Regulatory Commission (CSRC) to take on oversight. In the next section the role played by law enforcement agencies will be discussed to promote more accountable robo-advisors.

B. Investor Vulnerability and Fiduciary Responsibility of Robo-Advisors

Advice and management of financial investments involve robo-advisory services demonstrating increasing levels of automation and autonomy. Robo-advisors are capable of digitalizing investment management, as well as making all associated decisions. In business situations characterised by the involvement of robo-advisors, the high level of uncertainty indicates the importance of trust, particularly in terms of investors' attitudes toward financial advisors, as trustors, which creates vulnerability to the actions of a trustee.⁴⁷ While offering investment advice, many investors are vulnerable and need additional protection from coping mechanisms or benefits in order to mitigate their vulnerability. Robo-advisor clients are normally less sophisticated than professional investment clients, and will therefore find

46 KARTIK HOSANAGAR & VIVIAN JAIR, WE NEED TRANSPARENCY IN ALGORITHMS, BUT TOO MUCH CAN BACKFIRE, at <https://hbr.org/2018/07/we-need-transparency-in-algorithms-but-too-much-can-backfire> (Last visited on March 15, 2025).

47 ALEXANDER RÜHR, BENEDIKT BERGER & THOMAS HESS, *supra* note 39.

it more problematic to understand the consequences of conflicts or other problems. Therefore, these investors need reliable and informed advice. The elimination of human errors will also decrease liability and agency costs. Theoretically, robo-advisors also have the capacity to maintain continuous vigilance over the market, thereby facilitating prompt adaptation of the client's portfolio to swiftly evolving market dynamics.⁴⁸ This increased effectiveness will be favourable for both investors and financial service providers. The AI-related advantages of tackling the problems inherent in human decisions very much rest on the assumption that the AI algorithm is perfectly structured and coded.

Moreover, as a cheaper and therefore more accessible service, robo-advisors are marketed toward less experienced and financially unsophisticated investors. Therefore, robo-advisors could encourage more sophisticated investors, who do not need such straightforward and affordable access, to engage the services of professional financial advisors.⁴⁹ Many vulnerable investors are young and may have more trust in AI, and may also be willing to be involved in faster and more accessible financial advice through an online platform and mobile apps. However, these habits and preferences may create additional vulnerability in addition to those associated with their financial portfolios.

Fineman established a universal vulnerable subject defined by its shared and constant vulnerability, and called for a responsive state, stressing that the theme of vulnerability theory is the inequality of resilience between different parties.⁵⁰ This inequality allows us to argue for responsible and accountable corporations, so that mechanisms can be put in place for building resilience as 'a product of social relationships and institutions'.⁵¹ Moreover, concentrating on its philosophical foundation and the relationship between two parties (the vulnerable and the parties from whom they are at risk), protecting the vulnerable is seen as a matter of forestalling threatened harms.⁵² The principle of responsibility, as conceived by *Goodin*, is defined

48 JOINT COMMITTEE OF THE EUROPEAN SUPERVISORY AUTHORITIES, DISCUSSION PAPER ON AUTOMATION IN FINANCIAL ADVICE, at <https://www.esma.europa.eu/document/discussion-paper-automation-in-financial-advice> (Last visited on March 20, 2023).

49 Muhammad Anshari, Mohammad Nabil Almunawar & Masairol Masri, *Digital Twin: Financial Technology's Next Frontier of Robo-Advisor*, 15 *Journal of Risk and Financial Management* 163 (2022).

50 Martha A. Fineman, *The Vulnerable Subject: Anchoring Equality in the Human Condition*, 20 *Yale Journal of Law & Feminism* 9 (2008).

51 Martha A. Fineman, *Vulnerability and Social Justice*, 53 *Valparaiso University Law Review* 362 (2019).

52 ROBERT E. GOODIN, *PROTECTING THE VULNERABLE: A REANALYSIS OF OUR SOCIAL RESPONSIBILITY*, at 110 (University of Chicago Press, 1985).

as follows: ‘if A’s interests are vulnerable to B’s actions and choices, B has a special responsibility to protect A’s interests; the strength of the responsibility depends strictly upon the degree to which B can affect A’s interests.’⁵³ Vulnerability implies that there is an agent capable of exercising effective choices over whether to cause or to prevent the threatened harm. In the fintech context, that agent is the financial advisor, who represents their clients, namely the investors. They are fiduciaries, defined as ‘someone who has undertaken to act for or on behalf of another in a particular matter in circumstances which give rise to a relationship of trust and confidence’.⁵⁴ They are capable of making business judgements that can affect investors in either beneficial or harmful ways. ‘Minority communities’ in banking sectors have ‘culturally nuanced financial beliefs and behaviours’ that have an impact on their investment habits and strategies.⁵⁵ The fintech system may embed structural disadvantages that disproportionately affect minority and unsophisticated investors, often due to imbalances in control and access to information. Fintech platforms produce mechanisms which could result in discrimination against people speaking unsophisticated dialects, especially since they usually lack the ability and incentive to monitor financial advisors for the asymmetry of information. Fiduciary duties are proposed to be imposed on providers who offer services to vulnerable parties, involving possibly tortious or criminal liabilities.⁵⁶ Some robo-advisors have already met with criticism for putting company profits ahead of investors’ interests, and fiduciary rules or duties have been used to require financial advisers to act in the best interests of their clients.

While current legislation rarely imposes additional restrictions on financial advice services provided by human advisors, robo-advisors are facing stricter supervision and regulation due to their unique characteristics, nature and power. They have access to a vast amount of data with regard to trading information, market information, customer information, as well as research and development information. Government agencies may require an investment advisor qualification for robo-advisors using AI technology for investments. One legislative approach to enforcing the need for such a qualification could be the mandatory registration of robo-advisors under

53 *Id.*, 117-118.

54 *Bristol & West BS v Mothew* [1998] Ch 1, 18.

55 WHY FINTECH NEEDS DIVERSE THINKERS, COMMENT BY RAMONA ORTEGA, at <https://home.barclays/news/2020/12/why-fintech-needs-diverse-thinkers/> (Last visited on March 15, 2025).

56 Martha A. Fineman, ‘Elderly’ as Vulnerable: Rethinking the Nature of Individual and Societal Responsibility, 20 Elder Law Review 94 (2012).

existing securities regulation. The registration could be enacted in legislation through regulatory capital requirements and insurance for robo-advisors' misconduct, in order to fill the accountability gap caused by AI.

First, regulatory capital requirements have developed as an innovative approach in financial instruments by setting out minimum capital ratio requirements. These are designed to cover various risks and ensure that companies and financial institutions operating in financial industries are prudently managed. The mechanism aims to cover the risks inherent in the services offered by both robo-advisors and human advisors. It has been claimed that the main utility of legal capital mandates is to compensate for limited liability distortions and protect creditors and depositors against bank failures and operational risks.⁵⁷ Second, compulsory robo-advisor liability insurance from insurance companies registered with government agencies would be another way to protect depositors from risks associated with AI-assisted or AI-enhanced investment. Financial institutions should have separate accounts for investment facilitated by robo-advisors, and it would be feasible and prudent to require financial institutions using robo-advisors to purchase liability insurance with legally prescribed minimum coverage. The coverage would depend on the amount of the deposit to be facilitated by AI, and would allow registered insurance companies to price and assess the risks brought by robo-advisors and algorithmic failures. The registration process should be easy and straightforward, so that mandatory insurance would not constitute a significant market entry barrier for private and small insurance companies or put these companies in a disadvantaged position.

An additional regulatory channel would be supervising the natural persons involved, such as AI designers, operators and developers. They may be regulated in the same way as traditional individual financial advisors. The journey towards optimal regulation in this area will require the involvement of different stakeholder groups such as the designers, developers and users of AI, and other groups. These parties must include institutions at different levels such as law enforcement agencies, human advisors, and individuals such as IT decision-makers, developers and designers, chief data officers, chief data scientists, and data analysts. Designing a good regulation system for robo-advisors demands a central focus on how best to combine the knowledge of experts from different institutions and specialisms. Regulation of these nature permits the design of optimal strategies that benefit from the different strengths of a variety of regulatory instruments and parties.

57 Wen Shuangge & Zhao Jingchen, *Contextualizing Legal Norms: A Multi-Dimensional View of the 2014 Legal Capital Reform in China*, 19 *European Business Organization Law Review* 99 (2018)

Therefore, it is crucial to provide detailed registration and qualification requirements for investment advisors under different laws, such as securities regulation, company law and other soft laws. Moreover, fiduciary duties can and should be principally imposed upon fintech advisors. The duty includes avoiding conflicts of interest and effectively protecting clients' legitimate interests in good faith. When offering advisory services, advisors in the fintech industry are obliged to be faithful to their client's interests, owing their clients a duty of care with the obligation to ensure service quality and competence, and having a duty to provide investment advisory services diligently and prudently.

To link this duty to the notion of accountability and understand what the relation of accountability includes, one needs to consider its context, range, accountor, accountee, standards, process and implications. In the context of fintech, investors grant robo-advisors authority to serve their interests, while robo-advisors recognize that they will be held accountable for the ways in which such interests have been served. Based on both subjective and objective standards, the fiduciary duty can be seen as standards and ideals for the effectiveness of the service obtained as a result of the discharge of advisors' duties. Moreover, enforcing financial advisors' duties is crucially important to promote the effectiveness of the robo-advisor system. Considering that collective litigation is not a common practice in fintech and the lack of claims from vulnerable and minority investors, it is worth investigating the necessity and feasibility of using law enforcement to regulate robo-advisors.

C. Regulatory Oversight and Institutional Accountability

It is important to consider the issues involved in addressing the challenges brought by robo-advisors in fintech via the involvement of regulatory authorities. Successful experience can be observed in Australian law, where the law enforcement of breaches has been permitted and effective over the last two decades.⁵⁸ *Keay* suggested a series of benefits of law enforcement, including protection for investors who cannot fund private litigation,⁵⁹ sending messages to directors about the importance of their duties

58 See VICKY COMINO, 'COMPANY LAW WATCHDOG': ASIC AND CORPORATE REGULATION, at 1-16 (Thomson Reuters, 2015).

59 See Sections 260-263 of the *UK Companies Act 2006*. However, a broader range of applicants is adopted in Canada and Singapore. See Section 216A (1)(c) of the *Singaporean Companies Act 2006*; Section 238(a) of the *Canada Business Corporations Act 1985*.

and deterrence, and possibly enhancing the efficacy of private enforcement.⁶⁰ Compared with judges who are reactive, regulators are proactive enforcers, and they also have more expertise to sanction behaviours that are to the detriment of public interests.

In relation to the benefits of law enforcement in enhancing public interest, the Australian experience is also worth referencing as the Australian law enforcement agencies will only take action provided it is in the public interest. Here, the concept of public interest can be broadly interpreted according to the *Australian Securities and Investments Act 2001*.⁶¹ In China, the CSRC and its regional offices are the supervisors and administrators of the financial advisory sector. With the approval of the CSRC, investor protection organizations can bring public interest litigation against breaches of laws such as corporate law or securities regulation. These law enforcement agencies will take regulatory actions when advisors act in an accountable manner, including robo-advisors. The existing punishments that may be implemented in China include ‘correction, regulatory talk, letter of warning, submission of a compliance inspection report, or disciplinary action against the relevant person’.⁶²

Not having a conferred interest in the company means that law enforcement agencies may be more neutral in deciding whether there are valid reasons for action against misbehaving financial advisors. If they have the authority to enforce breaches of financial advisors, the commencement of proceedings against advisors will indicate to the advisors that the law enforcement agencies believe there has been misconduct. Such an indication may initiate communication among law enforcement agencies, financial institutions, and robo-advisors and their related human stakeholders, who could advise the law enforcement agencies in relation to further rectification and compliance. The law enforcement agency, with staff members with substantial experience and knowledge of financial services, will be both objective and efficient in the deterrence and correction of misconduct by financial advisors.

In addition to the role of enforcement and correction, law enforcement agencies may also use their notice-and-comment rulemaking authority to develop guiding principles and the regulatory framework governing the quality and competency of investment adviser advice.

60 Andrew Keay, *The Public Enforcement of Directors' Duties: A Normative Inquiry*, 43 *Common Law World Review* 118-119 (2014).

61 Section 50 of the *Australian Securities and Investments Act 2001*.

62 Article 33 of the *Interim Provisions on the Securities Investment Advisor Business*.

As for robo-advisors, the regulatory framework can also focus on how to make them perform diligently, faithfully and competently. Law enforcement agencies should focus on enhancing rules to monitor how conflicts of interest are eliminated through transparency and sanctions, since conflict biases from the application of robo-advisors will definitely impact all clients and their investment returns. Moreover, equipping investors with the information essential to make informed decisions in relation to providers of services, law enforcement agencies can introduce principles with a focus on ‘think small’, producing materials through accessible media such as ‘concise and direct’ brochures, ‘taking into consideration clients’ level of financial sophistication’.⁶³

Moreover, law enforcement will also enhance public interests. When law enforcement agencies are empowered to bring actions against financial advisors, they are able to take such actions where their decisions have failed to consider the interests of all investors in a fair, transparent and equitable manner. The financial industry is one of the most important and highly regulated industries. If robo-advisors are enabled to offer accessible and rapid investment advice and portfolio management services at a lower cost compared to traditional financial advisors, making them more accessible and cheaper will be important not only for individual investors, but also for the broader public interest. This can be beneficial for building public confidence and trustworthiness in the financial system. Of course, wider society has yet to reach a consensus on the ethical use of AI in financial services, and the application of AI in the financial service industry will only add a new dimension to this existing complexity. It is particularly interesting to observe that the shared benefits through AI are suggested as principles for designing, programming, utilizing and distributing AI. It reminds us of the importance of law enforcement agencies to monitor the robo-advisors’ duty to promote a more sustainable investment environment and protect vulnerable investors.

Law enforcement will facilitate wider representation by adopting an inclusive approach and considering a variety of investors when robo-advisors are employed, while human financial advisors will always find it economically profitable to serve wealthy clients, who are better equipped to make more informed decisions than vulnerable investors. Therefore, gaps in access to financial advice will likely contribute to accelerated wealth

63 SEC, GENERAL INSTRUCTIONS FOR PART 2 OF FORM ADV, at <http://www.sec.gov/about/forms/formadv-part2.pdf> (Last visited on March 15, 2025).

inequality. Law enforcement will impact the decision-making process of the programmers, AI users, robo-advisory platform designers, app developers, NGOs, data scientists, regulators, and independent gatekeepers, and push robo-advisors' performance towards a more progressive trajectory.

Moreover, regulating robo-advisors requires the participation of multidisciplinary teams with members playing particular roles associated with the safe and effective deployment of AI. The journey towards optimal regulation of robo-advisors requires the involvement of different stakeholder groups and gatekeepers, such as the designers, developers and users of AI, and data scientists who will also help to ensure that data are labelled appropriately. Such a varied group of stakeholders will bring a strong legal background with an understanding of the mechanics of complex algorithms.⁶⁴ It seems clear that regulating robo-advisors will require a smart regulatory approach, which recognizes broader regulatory influences and interactions including international standards organizations, peer pressure from industry associations and the developing professions, and civil society in different forms.⁶⁵ These broader regulatory influences and interactions will allow a smart framework to address concerns that robo-advisors present new and unknown risks with which current legislations are unfamiliar, designing new rules to mitigate the risks of AI with the collective efforts of a broad range of organizations. Smart regulation also fits the nature of fintech, which is typically agile, focused, data-driven and highly responsive to customer needs.

We also recognize that the effectiveness of law enforcement can be a concern. Records of law enforcement are likely to 'considerably underestimate the actual amount of corporate offending'.⁶⁶ If law enforcement agencies have additional roles in regulating robo-advisors, new regulatory tasks and streams must be matched by funding in order to help enforcers adopt these new roles. Therefore, additional public funding needs to be made available for law enforcement agencies, not only for *ex-ante* compliance for more transparent, explainable and trustworthy robo-advisors, but also for *ex-post* deterrence for more ethical, accountable and responsible robo-advisors. As government agencies, their assessments of whether robo-advisor recommendations are complementary for all potential

64 FRANCESCO D'ACUNTO & ALBERTO ROSSI, ROBO-ADVICE: AN EFFECTIVE TOOL TO REDUCE INEQUALITIES?, at <https://www.brookings.edu/research/robo-advice-an-effective-tool-to-reduce-inequalities/> (Last visited on March 15, 2025).

65 NEIL GUNNINGHAM & DARREN SINCLAIR, SMART REGULATION IN REGULATORY THEORY: FOUNDATIONS AND APPLICATIONS, at 134 (ANU Press, 2017).

66 Eugene Soltes, *The Frequency of Corporate Misconduct: Public Enforcement Versus Private Reality*, 26 Journal of Financial Crime 930 (2019).

investors are not only necessary, but also essential when the technology generating the advice is far outside the expertise of most investors.

D. A Human-AI Collaborative Framework for Responsible Advising

Robo-advisors recognize and accommodate different approaches to human interaction with their clients, and human interaction may step in at any stage of the advisory process, even just as a follow-up. Human advisors can provide an additional customer service element or input to the recommendations given by the robo-advisor. One of the most recent developments in fintech advisory development has been the creation of a hybrid robo-human model, which combines the use of automation and human expertise to provide financial advice to clients. This hybrid model combines programmed financial advice based on algorithms and big data, and human advisors with advanced digital and automated investing capabilities to remind clients of the potential risks that come with investment and clarify the duties of both robo-advisors and human advisors.

Both humans and AI have their strengths. Human advisors have strengths in ‘leadership, teamwork, creativity, and social skills’, while AI always prevails in ‘speed, scalability, and quantitative capabilities’.⁶⁷ The human advisor may also play the educational and psychologically comforting role of giving unsophisticated investors more information, instead of the box-ticking exercises that are common with robo-advisors. Human advisors may also get involved to help with key decisions, such as offering emotional and moral support to stay the course when the market tanks.⁶⁸ Moreover, a hybrid approach with human involvement will address complex issues impacting investors, industry providers, and government regulatory agencies.⁶⁹ While human advisors can effectively augment AI, AI can enhance the decisions and performance of human advisors, consolidated by a regulatory framework to support such a partnership.

67 H. JAMES WILSON & PAUL R. DAUGHERTY, COLLABORATIVE INTELLIGENCE: HUMANS AND AI ARE JOINING FORCES (JULY-AUGUST 2018), at <https://hbr.org/2018/07/collaborative-intelligence-humans-and-ai-are-joining-forces> (Last visited on March 15, 2025).

68 JANET NOVACK, VANGUARD ROLLS OUT NEW ROBO-HYBRID ADVISOR SERVICE WITH \$17 BILLION IN ASSETS, at <https://www.forbes.com/sites/janetnovack/2015/05/05/vanguard-rolls-out-new-robo-hybrid-advisor-service-with-17-billion-in-assets/> (Last visited on March 5, 2025).

69 WELLS FARGO/GALLUP SURVEY: INVESTORS CURIOUS ABOUT DIGITAL INVESTING, MORE OPTIMISTIC ABOUT ECONOMY PRIOR TO BREXIT, at <https://newsroom.wf.com/news-releases/news-details/2016/Wells-FargoGallup-Survey-Investors-Curious-About-Digital-Investing-More-Optimistic-About-Economy-Prior-to-Brexit/default.aspx> (Last visited on March 15, 2025).

While robo-advisors improve the effectiveness of existing services such as financial advice or asset management, the integration between AI and humans in the financial services industry will lead to ‘better outcomes’ such as ‘Next Generation Financial Advice’.⁷⁰ Hybrid models will create partnerships between human and robo-advisors and utilize the emotional and interactive advantages of human advisors by helping investors understand their investments and help them feel confident about them.⁷¹ At the current stage of AI application, robo-advisors may be more accurately understood as a tool that facilitates innovation when human advisors use them to pursue their ambitions. An additional advantage is that a hybrid model will lower the fees involved compared with traditional advisors by automating part of the investment process. For example, Schwab was the first financial institution to adopt a hybrid approach that combines its automated investment management technology with human advisors, and the flexibility brought by the model has not only increased competition but also given extra credibility to the use of robo-advisors.⁷² Hybrid models will offer the most cost-effective model by combining low-cost algorithms with a human component to supervise and provide overall portfolio analysis.

Considering the difficulties in establishing a transparent and efficient fiduciary standard for robo-advisors and the long process of accepting and adopting an accountability mechanism for independent robo-advisors, a hybrid model is the ideal option. Moreover, robo-advisors have not only disrupted methods of investing but also changed the demographics of investors, which is very closely linked with the investment culture and habits of investors with different age groups.⁷³ Investment culture represents investors’ beliefs, customs, values and social behaviour, and is usually characteristic of a particular group of people or society. It takes years for a culture to develop and establish itself within an investment environment, and once established, investment culture and habits can be extremely difficult to change. The deeply ingrained investment culture makes a hybrid model even

70 CHUCK GRACE & ANDREW SARTA, NEXT-GENERATION FINANCIAL ADVICE: REIMAGINING WEALTH MANAGEMENT IN THE AGE OF TECHNOLOGY, in THE TECHNOLOGICAL REVOLUTION IN FINANCIAL SERVICES: HOW BANKS, FINTECHS, AND CUSTOMERS WIN TOGETHER, at 301 (Rotman-UTP Publishing, 2020).

71 Bret E. Strzelczyk, *Rise of the Machines: The Legal Implications for Investor Protection with the Rise of Robo-Advisors*, 16 DePaul Business & Commercial Law Journal 64 (2018).

72 See ANNA IRRERA, CHARLES SCHWAB LAUNCHES HYBRID HUMAN-ROBO FINANCIAL ADVICE, at <https://www.cnbc.com/2017/03/14/charles-schwab-launches-hybrid-human-robo-financial-advice.html?msockid=32198e55091065ab39a49d8d08c26475> (Last visited on March 15, 2025); Jill E. Fisch, Marion Labouré & John A. Turner, *The Emergence of the Robo-Advisor*, Pension Research Council Working Paper, December 2018.

73 ZINA KUMOK, 3 REASONS MILLENNIALS SHOULD CONSIDER A ROBO-ADVISOR, at <https://money.usnews.com/money/personal-finance/articles/2016-04-07/3-reasons-millennials-should-consider-a-robo-advisor> (Last visited on March 15, 2025).

more realistic and feasible.

A hybrid model also echoes the importance of human-centred AI by combining algorithm-based investment methods with dedicated human oversight. Accountable robo-advisors will rely on the accountability of different human advisors and humans who are involved in the creation, development, design, application and enforcement of AI in the fintech industry. An important benefit brought by human-centred AI is the provision of personalized customer experiences.⁷⁴ When interacting with human advisors within a social network geared to investors' personal circumstances or attitudes to risk, investors are more inclined to carefully scrutinize the long-term prospects of their investments. Human advisors could train robo-advisors to perform certain tasks and explain the outcomes of the tasks, which will be particularly important if the outcomes are counterintuitive or controversial, and may interrupt investors' confidence in the responsible use of robo-advisors. For example, they may be more willing to invest in companies with corporate value driven by ESG integration within strategic management policies and operational activities than they are to take on risk. Human science enlightens AI research and AI application, leading to solutions that provide a highly productive, diverse and rewarding investor experience.

The robo-advisory industry has taken a piecemeal approach, advising on particular financial decisions at any given time. Building a hybrid model is a feasible option in the interim period before the emergence of holistic advisors that can handle multiple problems. It will also be a significant experiential process to accelerate the development of such a model. Hybrid forms of robo-advice can play a crucial role in reducing algorithmic aversion,⁷⁵ and the success of existing hybrid models indicates that the speed at which robo-advisory services are adopted will always be bounded by the support of human advisors. Trust and attitude change in relation to robo-advisors will change only gradually, and more accountable, transparent and trustworthy AI with regulation with clear, enforceable and explicit duties will mitigate the algorithmic aversion problem. The acceptance of robo-advisors very much depends on the attitudes of the predominant cohort of financial decision-makers in the economy. The use of a hybrid model will encourage the injection into the market of money that may otherwise

74 Anne L. Roggeveen & Sara Rosengren, *From Customer Experience to Human Experience: Uses of Systematized and Non-Systematized Knowledge*, 67 *Journal of Retailing and Consumer Services* 3 (2022).

75 ALBERTO G. ROSS & STEPHEN UTKUSY, *THE NEEDS AND WANTS IN FINANCIAL ADVICE: HUMAN VERSUS ROBO-ADVISING*, at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3759041 (Last visited on March 15, 2025).

have stayed on the sidelines, facilitating a healthy, well-balanced and robust market economy.⁷⁶

Since the design of robo-advising interventions is becoming ubiquitous worldwide,⁷⁷ robo-advisors could provide recommendations on how investors can construct their equity portfolios, with traditional advisors getting involved to highlight risks and clarify the duties of advisors, including providing the client with specific facts. Investors will then understand the types of products or services available to them, allowing them to assess possible risks and conflicts of interest. They will then be able to decide whether to follow the advice or not. The development trajectory of hybrid forms of robo-advice indicates that the development of robo-advisory services will be limited by the availability of humans, who will need to complement the advice of AI in a world dominated by human-centred algorithms.⁷⁸ In order to build a hybrid model, financial institutions must foster a solution through co-creation, employing human advisors to collaborate with robo-advisors to improve the effectiveness and efficiency of investment advice. What investors will appreciate will be a system that can provide real-time recommendations on how to increase their returns in a meaningful and sustainable manner.

V. CONCLUSION

Automated systems are increasingly making critical decisions about investors' financial decisions, potentially exposing the investors to new risks from flawed or biased algorithms. The lack of AI accountability is significantly hindering the adoption of AI in financial services. The provision of investment advice by robo-advisors is a successful and significant contribution of online investment guided and facilitated by AI. Because algorithms can be programmed to reflect companies' existing conflicts of interest, regulators should focus more on issues surrounding the duty of loyalty to make robo-advisors more accountable to their customers. This is particularly important considering that there are currently insufficient safeguards to protect investors from financial institutions' use of these platforms, which can amplify risks, unintentional errors, destructive bias and

76 HILARY KRAMER, ARE ROBO-ADVISERS THE FUTURE OF INVESTING?, at <https://investorplace.com/2015/11/robo-advisors-future-of-investing> (Last visited on March 15, 2025).

77 Francesco D'Acunto, Nagpurmanand Prabhala & Alberto G Rossi, *supra* note 18, 2018.

78 See Martin Krzywdzinski, Detlef Gerst & Florian Butollo, *Promoting Human-Centred AI in the Workplace. Trade Unions and Their Strategies for Regulating the Use of AI in Germany*, 29 Transfer: European Review of Labour and Research 53 (2023); David De Cremer, Devesh Narayanan & Andreas Deppeler et al., *The Road to a Human-Centred Digital Society: Opportunities, Challenges and Responsibilities for Humans in the Age of Machines*, 2 AI and Ethics 579 (2022).

dangerous design choices.

As AI continues to develop, automated financial advice services will become more sophisticated. It is critical to investigate the potential hazards of AI technologies so that their application can be aligned with human values and beliefs. It is therefore essential to highlight human involvement in AI application. This can be achieved by the use of hybrid robo-advisors combining the positive elements of AI and human portfolio analysis, and reflecting the importance of collaborative intelligence with humans and AI joining forces.

The development of AI in the fintech area is dynamic and rapid. Considering the advantages and pitfalls of robo-advisors, it would be wise to offer hybrid forms of human and robo-advisory services at the current stage, such as robo-advisors working alongside existing and mature human advisory services. In such a hybrid model, humans and AI can actively enhance each other's complementary strengths, and investors can communicate their risk-tolerance preferences to the human financial advisors. It is not easy to replace subjective and human elements when the human touch and emotional support to the investor are still needed, but a hybrid model will promote the characteristics of business processes that financial institutions generally want to improve, including flexibility, speed, scale, decision-making and personalization.

In order to promote more accountable robo-advisors in the context of collaborative intelligence, we also highlight the importance of transparency and impose the fiduciary duty to require financial advisers to act in the client's best interests. This duty may be supported and supervised by law enforcement. In addition to promoting the accessibility and effectiveness of robo-advisors, support from law enforcement agencies will help vulnerable investors who lack knowledge, resources and information.

In the future, there is huge potential for legal, fintech and AI researchers to investigate the regulation of robo-advisors specifically tailored to cater to the needs of particular groups of investors. For example, the main market for robo-advisory services is retirement planning for investors with medium incomes and less experience in investment.⁷⁹ These investors may be more inclined to become comfortable with AI-driven financial services, and have also been neglected by traditional financial advisors due to their relatively

79 See THE BOARD OF THE INTERNATIONAL ORGANIZATION OF SECURITIES COMMISSIONS, UPDATE TO THE REPORT ON THE IOSCO AUTOMATED ADVICE TOOLS SURVEY: FINAL REPORT, at <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD552.pdf> (Last visited on March 5, 2025).

low account balances. With the financial landscape being increasingly complicated and diverse, different groups of investors will have unique needs and risk profiles that warrant specialized attention, and investigation of the regulation of robo-advisors for different kinds of investors will lead to the development of targeted regulatory framework that enhances investor protection, promote transparency, and foster trust in the financial advisory industry.

(Edited by Li Jiesi)

人工智能金融顾问的问责机制与监管框架研究

内容提要 针对人工智能（AI）在金融咨询中日益扩大的影响，本文提出以机器人顾问问责机制与人类责任界定为核心的监管框架。该框架聚焦于破解 AI “黑箱” 难题——即因算法不透明与人类监管和解释能力的缺失，导致金融建议风险难以预测，进而引发不可控后果。文章系统评估了金融科技领域机器人顾问的应用现状、运行效能与潜在风险，构建强化 AI 工具问责的治理模型，并主张采用“人机协同”的混合咨询模式，将自动化技术与人工监督有机结合，以缓解算法排斥现象，确保金融服务在实现个性化和灵活性的同时，符合伦理与合规要求。
