INTERNATIONAL JOURNAL OF SOCIAL SCIENCES BULLETIN
ISSN: (E) 3007-1917 (P) 3007-1909
Volume 4, Issue 3, 2026

THE IMPACT OF COGNITIVE BIASES ON INVESTMENT DECISION-MAKING IN THE DIGITAL BANKING ERA

Rafia Khan[*1], Hira Aftab[2], Shahzad Ahmad[3], Fazila Khan Sherwani[4], Hassan Mushtaq[5], Zoha Khan[6]

[*1,2]*Institute of Business and Information Technology, University of the Punjab Lahore, Pakistan*
[3,5]*University of Engineering and Technology, Lahore, Pakistan*
[4]*University of Lahore, Pakistan*
[6]*School of Biochemistry and Biotechnology, University of the Punjab, Lahore, Pakistan*

[*1]rafiaa.khan2233@gmail.com, [2]hira.aftab@ibitpu.edu.pk, [3]engr.shahzadahmadqkw@gmail.com, [4]fazilakhansherwani@gmail.com, [5]hassanmushtaquet@gmail.com, [6]zoha33382@gmail.com

Corresponding Author: *
Rafia Khan
DOI: https://doi.org/10.5281/zenodo.22053947

Received	Accepted	Published
18 January 2026	03 March 2026	17 March 2026

ABSTRACT

Digital banking, financial technology (fintech), artificial intelligence (AI) and information and data are revolutionizing the global investment space. Digital Banking Platforms have also opened up financial markets more rapidly, making real-time transactions, automatic investment advice, personalised financial services and market information much easier to access. While these technological developments have enhanced the efficiency, transparency and financial inclusion, they have also ushered in fresh behavioural challenges that can affect investors in the decision-making process. Despite the increasing complexity of digital financial systems, cognitive biases still play a crucial role in financial decision-making, causing irrational judgments and poor financial outcomes. This article gives a critical review of the effect of cognitive biases in investment decisions while using digital banking. It uses the theoretical concepts of behavioural finance (Prospect Theory, heuristic decision making etc) to bring together the most recent research into the cognitive factors that influence thinking (overconfidence effect, anchoring effect, confirmation bias, herd psychology, availability effect, mental accounting and loss aversion). This article explores the potential of financial institutions, fintech firms, regulators and policymakers to tackle cognitive biases by means of investor education, ethical use of AI, transparent algorithmic governance, and behavioural interventions. It also identifies the new research topics such as explainable AI, personalised investment advisory systems, digital financial literacy, and behavioural analytics. The article combines behavioural finance, digital banking and financial innovation to offer practical guidance for building financially resilient, inclusive and behaviourally-informed digital financial systems.

Keywords: *Behavioural Finance, Cognitive Biases, Digital Banking, Financial Technology (FinTech), Robo-Advisors, Financial Innovation, Digital Financial Services*

1. Introduction

In the past two decades, the financial sector has been experiencing a radical transformation with the rapid development of financial technology (fintech), artificial intelligence (AI), big data analytics, cloud, and blockchain technology. The

innovations have changed the way businesses are done in financial institutions as well as how consumers access financial services. The banking sector, once a strictly physical and on-the-ground business, is now an extremely well networked digital space where banks offer financial services through mobile applications, internet banking websites, digital wallets and artificial intelligence-based financial advisory solutions. This transformation enhances operational efficiency, enhances customer service, widens financial inclusion and changes the global financial environment (Mundial, 2022).

Digital banking is a central component of the financial world today. Thanks to smartphones, Internet and digital payment options, banking and investment services can be available anytime, anywhere. Digital financial services have significantly broadened access to formal financial institutions, particularly in areas of the world where the traditional financial network is not as strong, for example, the developing and emerging economies of the world (Mundial, 2022). Financial technology companies' quick expansion also has caused the financial sector to become more competitive, with new products entering the market such as robo-advisors, digital investment platforms, algorithm-driven portfolio management systems, peer-to-peer lending, and cryptocurrency exchanges (Bhatt et al., 2022). The technology has also facilitated the investment process, and enabled a financial product market with retail investors and sellers. The technology has also contributed to making investment opportunities more readily available; and making the market for financial products available to retail investors and sellers. These technological developments have taken place, but the investment decision-making process is still a complex cognitive debating process that is affected by psychological, emotional and social factors. Classical principles of finance, like the Efficient Market Hypothesis (EMH) and the Expected Utility Theory, consider the investor as a rational agent who bases his choice of investment decisions on the maximization of the expected utility of the investment decision, by taking into account all the information available to him in a very objective way (Lo, 2022). However, empirical studies suggest that investors are not always rational decision makers due to consistent cognitive biases, emotions, and the ability to handle information overload over the last few decades (Botzen et al., 2025). These deviations have led to the development of behavioural finance, a new interdisciplinary field that combines psychology and economics to understand the psychological determinants of financial behaviours and outcomes (Imade, 2024).

Behavioural finance suggests that investors use heuristics, or mental shortcuts to make decisions when they are uncertain. Heuristics can be useful for making decisions quickly, but they can also cause predictable cognitive biases that can undermine judgment and lead to irrational investment behaviours (Ahmad & Shah, 2022). Overconfidence, anchoring, confirmation bias, herd behaviour, availability bias, framing effects, mental accounting, and loss aversion are among the most widely studied biases of cognition. These biases can be seen in various ways, such as an investor's perception of risk, evaluation of information, estimation of future returns, and allocation of financial resources, and often lead to over-trading, poor portfolio diversification, speculative investing, and sub-optimal financial performance (Ahmad & Shah, 2022).

Advancements in financial services digitalization have created a new layer to behavioural finance. Unlike conventional banking facilities, digital banking platforms regularly publish investors with real-time information on the market, algorithm driven suggestions, social media discussions, customized financial content and immediate trading opportunities. The mobile investment apps provide instant access to the financial markets, which allows investors to trade in only a few seconds. These technologies are useful and facilitate the way people can access financial information, but they can also create conditions that can intensify psychological biases: they can increase frequency of trading, cause emotional decision making, create information overload, and create social influence. Gamification, push notifications, personalisation, and social trading communities can all lead to false signals of over

optimism, herd mentality and confirmation bias, and raise the risk of irrational investing decisions (Thaler, 2022).

Digital technologies can also serve to reduce behavioural biases simultaneously. AI and machine learning coupled with robo-advisory can effortlessly process and analyse vast amounts of information from the broader financial ecosystem, thereby delivering data-driven financial recommendations, and aid in disciplined portfolio management. AI investment platforms also offer a way to reduce emotional trading by encouraging strategic investment decisions and long-term strategy (Wexler & Oberlander, 2021). However, the technologies also generate new concerns with algorithmic transparency, algorithmic bias, data privacy, cyber security, and the ethics of algorithms. Understanding the relationship between cognitive biases and digital banking technologies is important for financial institutions, investors, regulators and policymakers to be aware of and to ensure good investment practices, particularly one focused on responsibility and sustainability.

While there is much research on behavioural finance, most of the literature has been concerned with traditional investment markets rather than digital financial ecosystems. Similarly, research on digital banking has largely focused on technological uptake, financial inclusion, operation efficiency and customer satisfaction, while the psychological processes that influence investor actions in digital platforms are given comparatively less focus. Digital financial services are becoming ever more dynamic, leading to the need to apply behavioural finance to digital banking research, in order to understand the impact of technology innovation on cognitive decision-making processes. This holistic view is crucial for the design of a digital financial system that will create efficiencies and facilitate rational, transparent, and responsible investment behaviour. The article aims at filling this gap, by synthesizing the available literature on the cognitive biases and investment decision making in the digital banking era. It looks at the theoretical underpinnings of behavioural finance, considers the key cognitive biases that impact investors, and analyses the impact of new digital banking technologies (mobiles, fintech, robo-advisors, artificial intelligence, algorithmic trading systems, social trading networks) on investor behaviour. The article also explores the impact of these interactions on financial institutions, fintechs, regulators and policy makers, and offers suggestions on how to address behavioural biases through financial education, ethical AI usage, algorithmic governance transparency, and behaviour-informed design of digital platforms.

2. Evolution of Digital Banking and Financial Innovation

2.1 From Traditional Banking to Digital Banking

The banking sector has experienced one of the most significant changes in the history of economic activity, from branch offices to ever-connected financial systems. For centuries, banking products and services have been provided in a brick-and-mortar environment, and customers used to go to the bank for cashing in and out, taking loans and giving their money for investmentLimited operating hours, physical locations, processing times, and increased operating costs (Boot et al., 2021). The path towards digital banking has been gaining momentum due to globalisation, information and communication technologies (ICT) and customer expectations. In addition to the digitalization of traditional banking operations, digital banking incorporates cutting-edge technologies to facilitate real-time transactions, customised banking services, and data-driven decision-making via mobile and internet banking, digital wallets, biometric authentication, and cloud platforms (Basharat & Azmat, 2024). This transformation has broadened financial access, increased the efficiency of financial services, and helped boost financial inclusion by bringing populations out of the informal financial system into formal financial services using digital technologies (Demirgüç-Kunt et al., 2022).

Financial institutions strengthened the adoption of remote service, contactless payment and digital interaction with customers during the COVID-19 pandemic, which has further accelerated the

adoption of digital banking (Väisänen, 2025). These transformations have affected the customer's expectations and convenience, speed, personalization and security have become financial services competitive tools and drivers of customer satisfaction. At present, banks are no longer only financial agencies, they are platforms that are innovating through technology to satisfy their customers and engage with the outside digital world, providing a variety of financial products and services. Banks are now providing integrated financial services, such as digital payments, investment management, insurance, wealth management, and personal financial planning, in a single digital platform thereby partnering with fintech companies along with technology companies and third-party service providers (Boot et al., 2021).

Digital banking allows financial institutions to build robust customer relationships, via ecosystem-centric services and personalisation based on data. Digital interactions provide valuable information for credit risk assessment, fraud detection, personalised financial services and risk management, and AI and predictive analytics improve financial decision making (Osei et al., 2023). The digital transition also brings its own set of issues when it comes to cyber security, privacy of data, transparency of algorithms and ethics and good governance, for which robust regulation is needed. Additionally, digital banking has opened up investment to retail investors, thanks to the ease of access to trading platforms, portfolio management, automated investment advice, and the availability of financial information in real-time via mobile applications. The decrease on the transaction costs and information asymmetry has expanded the involvement in the capital market, especially among younger and technologically advanced investors (Liu et al., 2024). However, greater ease of access has also led to greater susceptibility to behavioural effects, since real-time market information, algorithmically curated content, and social media-driven trends can tempt investors to make hasty, rash, and speculative decisions, and far too many trades. This has led not only to changes in the way financial services are being provided, but also to a change in the way the investment decision process is addressed in the cognitive category, adding to the importance of linking technological innovation and behavioural finance perspectives. Banking has undergone several technological phases – from branch to digitally integrated financial ecosystems. Figure 1 shows how the concept of modern banking technologies has evolved since the era of traditional banking models to mobile banking, fintech platforms, artificial intelligence, and the new digital financial infrastructures. The shift from traditional banking to digital banking goes beyond service delivery and is a reflection of the changing dynamics of accessibility, banking models, customer engagement, and technology. Table 1 provides a summary of the important differences between older bank models and the newer digital banking models.

Table 1. Evolution of Banking: Traditional Banking versus Digital Banking

Dimension	Traditional Banking	Digital Banking
Service delivery	Physical branches	Mobile and online platforms
Customer interaction	Face-to-face	Digital, omnichannel, and AI-assisted
Operating hours	Limited business hours	24/7 availability
Transaction speed	Manual and relatively slow	Instant or near real-time
Cost structure	High operational costs	Lower operational and transaction costs
Investment services	Advisor-dependent	Self-directed platforms and robo-advisors
Decision support	Human financial advisors	AI, analytics, and algorithm-driven recommendations
Customer data utilization	Limited	Big data analytics and predictive modelling

Accessibility	Location dependent	Global and remote access
Competitive model	Institution-centered	Platform-based ecosystem with fintech integration

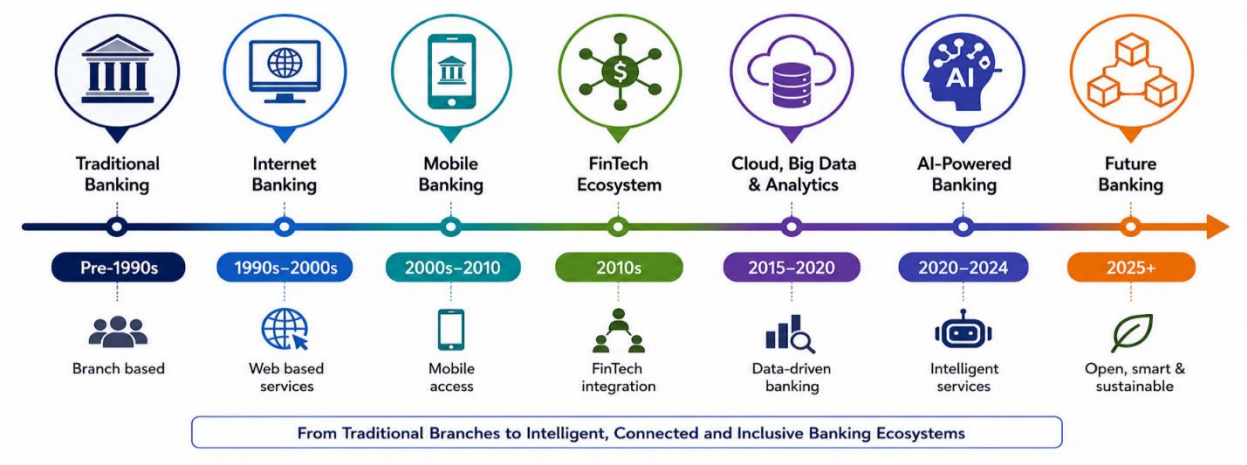


Figure 1. Evolution of Modern Banking Technologies

Conceptual illustration showing the evolution of banking technologies from branch-based banking to internet banking, mobile banking, fintech integration, cloud computing, artificial intelligence, blockchain-enabled financial services, and open banking ecosystems.

3. Theoretical Foundations of Behavioural Finance

To gain an understanding of investment decision-making in digital banking, it is necessary to have an appreciation of the theoretical development of the financial decision theories. The classical theory of finance has been based on the assumption that investors are rational information processors and utility maximisers. But, over the years, the empirical evidence has cast doubt on these assumptions, as financial decisions have often been made on psychological, emotional and cognitive grounds. Thus, it seems that a new interdisciplinary discipline has developed, namely behavioural finance, which combines the concepts of economics, psychology and decision sciences to account for systematic deviations from the rational investor's behaviour (Kubińska et al., 2023).

Behavioural finance is a huge paradigm shift from the old finance. Behavioural finance not only considers irrational behaviour a deviation, but relatively, cognitive biases and heuristics are integral to people's decisions, especially when they make decisions under uncertainty. In the realm of digital banking, where investors are inundated with a wealth of data, algorithmic suggestions, social media buzz, and real-time price movements, this viewpoint is particularly pertinent. The concepts summarised in this section serve as the conceptual framework to understand the impact that cognitive biases have on investment decisions in increasingly digital financial systems.

3.1 Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) was first proposed by Fama (1970) and has been the bedrock of classical financial economics for a long time. Financial markets are informationally efficient, according to the EMH proposition, which states that security prices incorporate all information about the security and do so instantaneously and completely. Within this paradigm, investors are expected to process information objectively, and act rationally to make decisions that maximize their expected return. It is therefore concluded that it is not possible for investors to generate any abnormal returns consistently by superior information analysis since the market quickly reacts to the new information. The market efficiency has been categorized as weak-form, semi-strong-form and strong-form efficiency (Lo, 2022)(Gbanador, 2021). The weak-form efficiency of the market implies that past

price information has already been incorporated into the price of a stock, making technical analysis useless. Semi-strong-form efficiency further assumes that all publicly available information gets reflected in market prices at the same time as strong-form efficiency claims that even private/insider information is also being reflected in asset prices. These forms suggest that markets are efficient mechanisms of rationally allocating financial resources (Gbanador, 2021).

Though EMH has had significant impact on modern portfolio theory, asset pricing theory and investment management, it has been challenged by empirical observations over the years. Financial anomalies like speculative bubbles, momentum effects, too much volatility, calendar anomalies, and overreactions by investors do not fit into perfectly efficient markets (Vasileiou, 2021). Furthermore, there is a lot of evidence that investors make irrational trades, suffer panic sell-offs and experience persistent mispricing, all of which indicates that investors have poor objectivity in processing information. The fast digitization of the financial markets also attacks the EMH. Investors have access to a wealth of financial data on digital platforms through mobile apps, online trading platforms, and social media channels, with the ability to access them at any time. But there is the possibility of information overload, emotional trading and an increased risk of behavioural biases becoming apparent as a result of the constant information being available rather than removing irrational behaviour. Digital technologies, in turn, do not guarantee rational decision-making or perfectly efficient markets, but carry forward the process of transparency of the markets.

3.2 Expected Utility Theory

Expected Utility Theory (EUT)[18] is a normative theory that supports rational decision making under uncertainty (Vilela & Oluyemi, 2021). This theory is an assumption that a person would make choices that maximize expected utility (the theory does not say they would trade away money for greater utility). The investor is assumed to be assigning probabilities to the different possible outcomes and choosing the outcome that he/she would be most satisfied (or most utility) with. The theory has a few basic axioms, including incompleteness, transitivity, continuity and independence. Together these assumptions mean that rational investors have stable preferences, they are able to consistently rank available alternatives, and are able to make logically coherent choices in the face of contextual influences (Höppner, 2026). This has been incorporated into a large number of financial models including portfolio optimization, insurance and risk management systems, so the theory is called Expected Utility Theory. The models of the Expected Utility Theory are in theory elegant, but empirical studies have revealed that the behavior of investors may be different from the theory. Individuals may experience a combination of wants, feelings about both positive and negative events, feelings of financial gain/loss and oversensitivity to uncertainty. The experimental analysis has discovered that investors are not necessarily willing to give up on the objectively better options but may be avoiding the better options because of framing effects, regret, ambiguity aversion and reference-dependent preferences (Dordevic et al., 2026).

The results demonstrate that not only the probability of occurrence but also the psychological perception of is affecting the decision-making process. The disadvantages of the EUT are more apparent in digital banking environments. Digital investment platforms provide investors with real-time updates, tailored recommendations, and the latest news, all year round. These are a context for faster decision-making, which may be based on what is intuitively believed to be correct, rather than on utility maximisation. So, digital financial ecosystems further highlight the need for behavioural modeling of investors' real behavior rather than perfect rationality.

4. Cognitive Biases Affecting Investment Decisions

Rational choice models have conventionally been used to explain decisions about investment, with the assumption that the investor rationally considers the information available and chooses to

pursue options with the highest expected returns. But much behavioural finance research shows that financial decision making is not always rational. In the face of uncertainty, information asymmetry and volatility, investors often use cognitive shortcuts, emotions, and subjective judgments to make investment decisions (Dordevic et al., 2026). These are known as cognitive shortcuts, or heuristics, and can lead to systematic errors called cognitive biases.

In a digitalization of financial systems that is gaining momentum, cognitive biases have become even more prevalent. Digital banking platforms offer investors ongoing data, algorithm-driven suggestions, financial news alerts, and social media content, and set the scene for quick data ingestion and repeated decision-making. In addition to making markets more accessible and investment opportunities more abundant, technological innovations can also increase behavioural biases, which are caused by information overload, algorithmic reinforcement, social influence and ongoing market exposure (Svoboda, n.d.). The following are some of the key cognitive biases that impact investment decision-making, and their implications to investors, financial institutions and digital investment platforms. Cognitive biases can impact investment decisions, as they affect how people see information, process risks, and interpret investment results. The conceptual relationship between cognitive biases, investors' decision-making processes and the investment outcomes is summarized as follows in figure 2.

4.1 Overconfidence Bias

Overconfidence represents one of the most extensively documented cognitive biases in behavioural finance and refers to the tendency of individuals to overestimate their knowledge, analytical abilities, and capacity to predict future market outcomes. Generally, overconfident investors think they have better information or investment expertise than other investors, and as a result, they tend to underestimate the uncertainty of investments and overestimate the expected returns (Karki et al., 2024).

The literature on behavioural research indicates that overconfidence can come in several forms: in believing they are capable of performing a skill better than others; in being more certain of their knowledge than others; in feeling a sense of control over situations that are actually out of their control (Singh et al., 2024). These expectations and these mental habits lead to excessive trading, inflated risk perception and recognition, avoidance of contradictory information, and unrealistic expectations of portfolio performance. Empirical research has long shown that overconfidence is a bad quality for investors. Overconfident investors made far more frequent trades than rational investors, causing them to experience lower net returns from their trades because of higher transaction costs and ineffective market timing (Awalakki & Archanna, 2023). Similarly, individual investors have been found to expect outperformance despite the lack of evidence that leads to higher portfolio volatility and lower long-term investment performance (Singh et al., 2024).

With the rise of digital banking and online investment platforms, new aspects of overconfidence have emerged. Retail investors may become "experts" when they use mobile trading applications that allow them to instantly access financial markets, real-time analytics, interactive charts, and advanced trading tools. Easy and quick trading on the internet can lead to overconfidence and speculation. In addition, algorithm-driven performance dashboards and tailored investment suggestions can help to assuage investors' sense of control, even amid ongoing market volatility. AI-driven advisory platforms provide opportunities to reduce the overconfidence effect by providing evidence-based recommendations based on facts, but sometimes the overreliance on algorithmic outputs can also lead to automation bias, where investors may blindly follow technological advice without considering it. For this reason, digital banking offers some mechanisms that feed into and limit overconfidence as a function of platform design and investor financial literacy.

4.2 Anchoring Bias

Anchoring bias refers to the tendency to remember the first piece of information given when making further decisions or judgments (Dordevic et al., 2026). With an anchor in place, investors often make adjustments that are inappropriate, even when new or conflicting evidence is provided. As a result, investment decisions are made based on past prices, past market performance, analyst expectations or even the price paid at the time of purchase, instead of market fundamentals. In the financial markets, anchoring can affect various steps of the investment decision-making process. Investors frequently have a tendency to "buy it low and sell it high," and when the market conditions get bad, they sell securities when they are below what they paid. Similarly, past prices can have psychological significance as they affect expectations about future prices, even if there has been a significant change in the economy.

Digital banking platforms can perpetuate anchoring effects by prominently showing historical price charts, comparisons of prices to benchmark, previous portfolio values and analyst target prices. These features are useful to the market, but could lead investors to overlook the objective assessment of the current market fundamentals and instead overtrade past performance. The fact that investors may receive historical information on a continuous basis via mobile investment applications, may therefore, reinforce reference dependence and diminish investors' willingness to update their earlier beliefs. Studies have revealed that the anchoring effect leads to slower portfolio rebalancing, under- or over-allocating assets, and inaccurate risk assessment. However, in times of volatile financial markets, using too many reference points in the past can make investors less inclined to adjust to the economic environment, which lowers portfolio efficiency and increases investment risk.

4.3 Confirmation Bias

Confirmation bias refers to the tendency to seek, interpret, and recall information that confirms existing beliefs while ignoring contradictory evidence (Peters, 2022). In investment decision-making, these biases influence stock selection, portfolio management, and market forecasting, leading investors to overvalue favourable information and underestimate risks. The digital transformation of financial services has further amplified confirmation bias through social media, personalised financial news feeds, recommendation algorithms, and AI-driven content delivery systems (Svoboda, n.d.). Cognitive biases can impact investment decisions, as they affect how people see information, process risks, and interpret investment results. The conceptual relationship between cognitive biases, investors' decision-making processes and the investment outcomes is summarized as follows in figure 2.

Online investing communities have grown more concerned about confirmation bias in light of new trends in the digital investment arena. Discussion about the same thing via social media or the same financial influencers can reinforce the investor's beliefs. What this means is that investors can be even more sure that the markets are wrong and ignore the reality of hard money (Sathya & Gayathiri, 2024). Financial institutions and digital platform developers can take several steps to reduce the risk of confirmation bias, including by incorporating a balanced presentation of information, offering tools to present information in a format that is easily digestible for investors, and implementing behavioural nudges, or strategies that can nudge a person's decision-making process, to remind investors to seek out alternative viewpoints before making investments. These can be used to improve decision quality by promoting information processing and reducing psychological polarization in financial decision-making. Numerous cognitive biases have been documented in the field of behavioural finance, with varying psychological mechanisms driving each bias impacting an investor's judgement. Table 2 summarizes the key cognitive biases, a definition, a cause, and possible effects on a person's investment decision.

Table 2. Major Cognitive Biases, Definitions, Causes, and Investment Consequences

Cognitive Bias	Definition	Underlying Cause	Investment Consequences
Overconfidence	Overestimating one's knowledge, forecasting ability, or investment skills.	Illusion of knowledge, illusion of control, self-attribution.	Excessive trading, underestimation of risk, poor portfolio performance.
Anchoring	Relying heavily on initial information or reference points when making decisions.	Dependence on historical prices or initial market information.	Delayed portfolio rebalancing, inaccurate valuation, irrational holding decisions.
Confirmation Bias	Seeking information that confirms existing beliefs while ignoring contradictory evidence.	Selective information processing and belief reinforcement.	Poor diversification, delayed corrective actions, biased investment judgments.
Herd Behaviour	Following the actions of other investors instead of conducting independent analysis.	Social influence, fear of missing out (FOMO), uncertainty.	Asset bubbles, market volatility, speculative investments, panic selling.
Loss Aversion	Experiencing losses more intensely than equivalent gains.	Emotional sensitivity to financial losses and reference dependence.	Holding losing investments too long, premature profit-taking, inefficient portfolios.
Availability Bias	Making judgments based on information that is easily recalled or recently encountered.	Media exposure, recent market events, memorable experiences.	Overreaction to recent news, misjudgment of probabilities, short-term decision-making.
Framing Effect	Making different decisions depending on how identical information is presented.	Context-dependent interpretation of gains and losses.	Inconsistent investment choices, altered risk perception, irrational responses to financial information.
Mental Accounting	Separating money into different psychological categories rather than evaluating total wealth.	Cognitive compartmentalization of financial resources.	Poor asset allocation, inefficient diversification, inconsistent investment strategies.

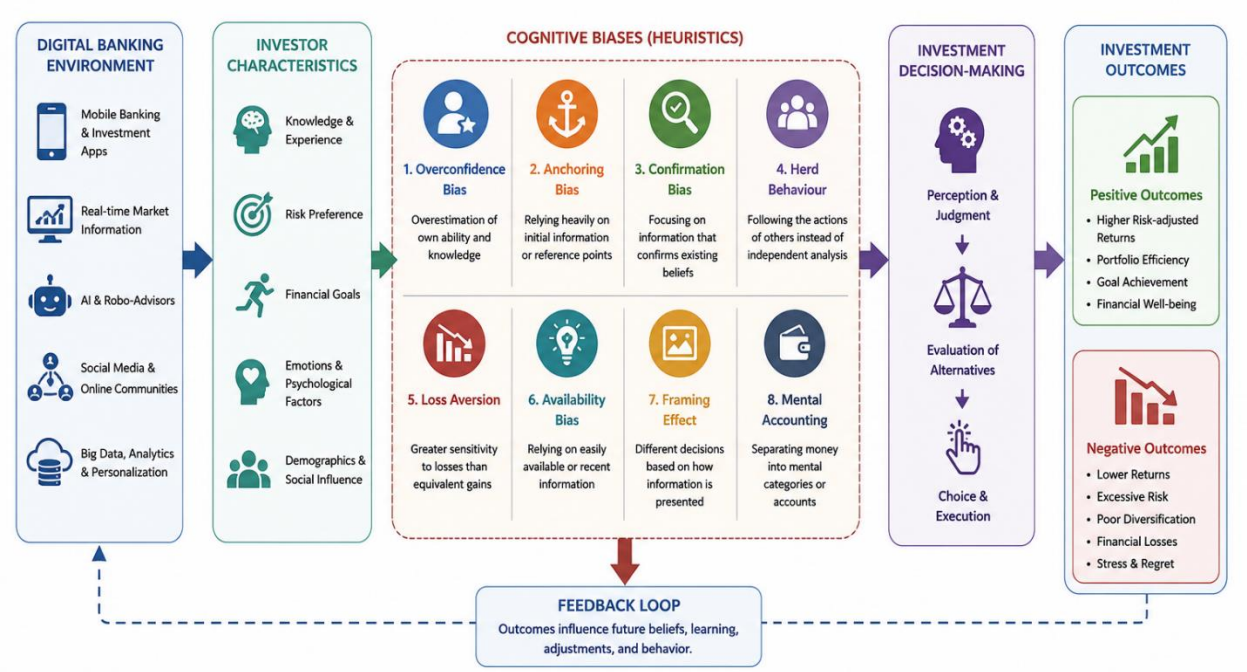


Figure 2. Conceptual Framework Linking Cognitive Biases with Investment Decision-Making

Conceptual framework illustrating how cognitive heuristics generate multiple behavioural biases that influence investment decision-making and ultimately affect investment performance within digital banking environments.

5. Digital Banking as a Driver of Investor Behaviour

The world of financial services is undergoing a digital revolution, one that has dramatically altered the way that people interact with and evaluate financial services, as well as making investment decisions. Unlike traditional banks, which have to engage financial advisors and institutional intermediaries to provide investment advice, digital banking empowers investors to make their own investment decisions via mobile applications, AI-powered financial advisors, algorithm-based investment products, and social media. The use of such technologies has brought the market to be more accessible and lowered the cost of transactions and opportunities to invest more for a larger audience. They have however, also changed the cognitive landscape in which investment choices are taken by allowing investors to get constant streams of information, personalized recommendations, and real-time market feedback (Gulati et al., 2026)(Pandey et al., n.d.).

Digital banking platforms also influence investment behaviour through the behavioral mechanisms that impact perception, attention, and judgment, in addition to efficiency of this application. Financial institutions are now able to tailor financial investment solutions to individual preferences and user actions through the use of behavioural analytics, machine learning, recommendation engines, and user-centric interface design. The production of these developments will facilitate the availability of information for financial decision-making and reduce information asymmetry, but at the same time, it may exacerbate cognitive biases such as overconfidence, confirmation bias, herd behaviour and loss aversion (Ranjan, 2025). As more individuals become interested in using these technologies to generate sustainable investment behaviours, financial service professionals and policy makers need to have a deeper understanding of these new technologies, which relate to investor psychology.

5.1 Mobile Banking and Investor Behaviour

Mobile banking has become one of the largest innovations in banking and financial services and enables investors to easily gain access to banking and investment applications through their mobile phones and other portable devices. The mobile banking apps are now bringing together several financial aspects into one digital door, including transferring money, managing the portfolio, making digital payments, making investments, monitoring the market and financial planning. It has led to convergence of services which has significantly improved the convenience, flexibility and enhanced financial inclusion, and reduced traditional bank-based banking systems' dependence (Demirgüç-Kunt et al., 2022).

Mobile banking has significantly changed investors' habits – reducing the time and distance needed to deal with the financial market. Now, traders can track their portfolio, get market notifications, and trade within seconds, no matter where they are. Greater access to the market can improve participation but can also lead to over-trading and short-term investment attitudes. Being constantly bombarded with price changes and instant alerts of market movements may intensify emotional responses to market volatility, resulting in investors making hasty decisions based on short-term price swings instead of long-term investment strategies. Research on behavioural finance has indicated that over-observing the portfolio may lead to "myopic loss aversion", meaning that investors are unduly affected by short-term losses, and are not sufficiently attuned to long-term gains (Wesslen et al., 2021)(SAHU, n.d.).

Mobile banking applications can inadvertently be responsible for this trend in the form of constant performance updates, price alerts and interactive dashboards that constantly draw investor focus to market movements. The advantages of mobile banking also drive greater market efficiency and customer engagement, but can also have the downside of emotionally-driven behavioural biases. The regulatory side of mobile banking platforms are becoming more and more sophisticated, implementing behavioural interventions like investment reminders, portfolio diversification prompts, and educational content to help promote disciplined investing. The features illustrate that digital banking can be both a tool to exacerbate and ease behavioural biases depending on the platform design and investor financial literacy. The implementation of digital banking technologies has reshaped the investment decision-making landscape, impacting how investors access information, engage with financial services and implement investment strategies. Figure 3 illustrates the connection between digitisation of banking innovations, behavioral mechanisms, cognitive biases, and investment results.

IEER
Institute for Excellence in Education & Research

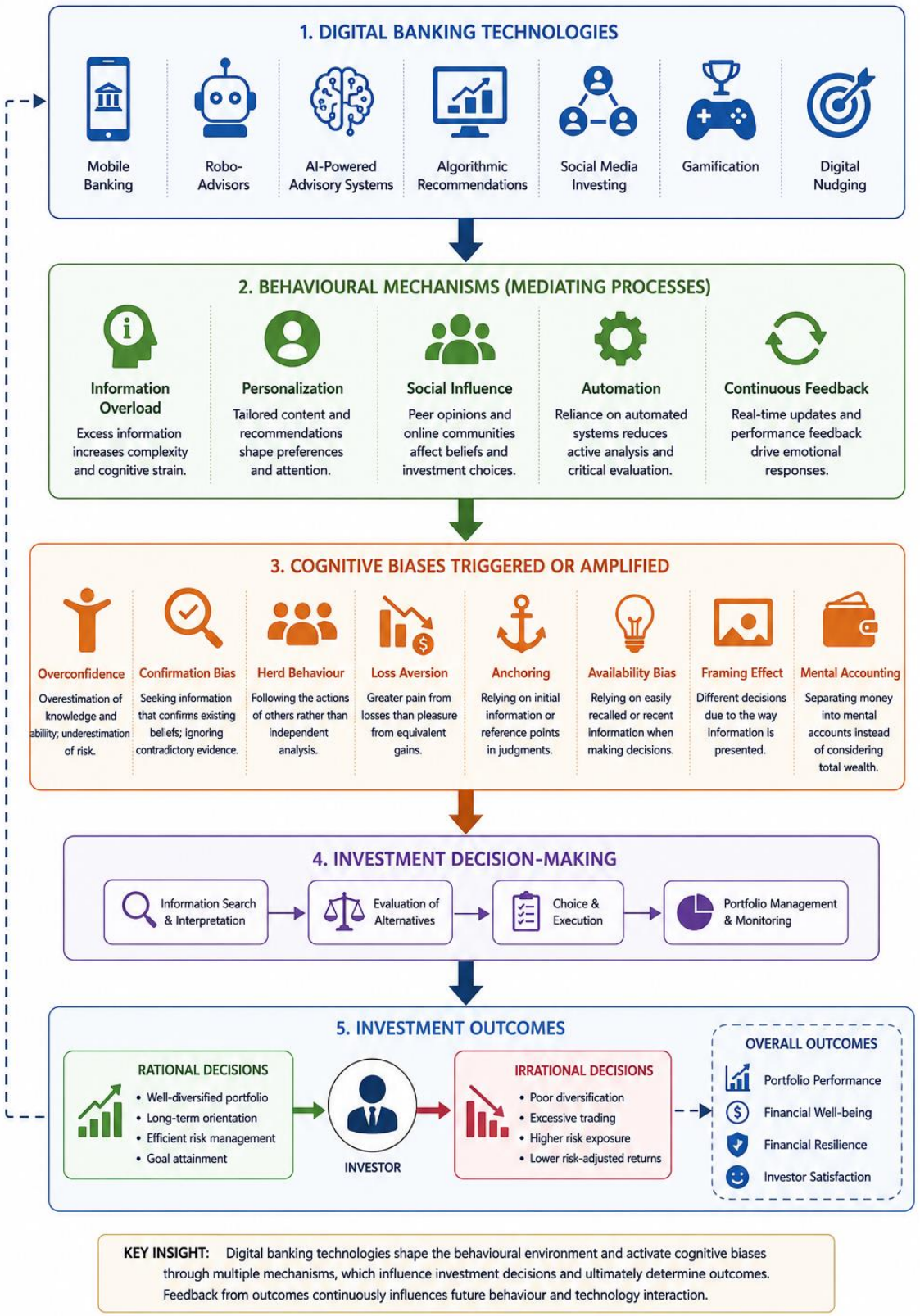


Figure 3. Digital Banking Technologies Influencing Investor Behaviour

5.2 Robo-Advisors and Automated Investment Management

Robo-advisors use models that rely on algorithms to generate automated portfolio recommendations that take into account investors' personal preferences, investment goals, risk tolerance, and investment time horizon. The aim of robo-advisors is to offer investors unbiased, personalized and inexpensive investment guidance, while reducing the need for conventional human financial advisors to apply conventional theories, such as modern portfolio theory and machine learning methods (Barile et al., 2025).

One of the key benefits of robo-advisory services is its ability to help eliminate emotional decision-making (Orzeszko & Piotrowski, 2024). However, algorithmic portfolio management isn't about reacting to the market, it's about investment algorithms and quantitative models. This could go a long way in helping to reduce behavioural biases, such as overconfidence, panic selling and over-trading, as robo-advisors encourage regular portfolio rebalancing and long-term investing discipline. The robo-advisors, however, are most effective when investors are sure of the trustworthiness of the robo-advisor and are knowledgeable about how the algorithms function. Automate your advisory services for more consistent investing. However, investors may be subject to automation bias, that is, when they blindly follow the recommendations made by an automated system without critically evaluating them. Relying on automated systems could complicate the process for investors to evaluate market conditions and financial risk, particularly when trying to gauge market conditions during times of unparalleled market volatility when historical data may not be as relevant. Recent developments in explainable artificial intelligence (XAI) are working to fill in these shortcomings by enhancing the transparency of investment recommendations (Tahvildari, 2025). Transparency of the algorithmic decision-making process for investors can increase the level of trust in the system and rationally optimize investment behavior. So, robo-advisors need to be considered as a supportive tool to make financial decisions, not as a replacement for human financial sense.

5.3 AI-Powered Advisory Systems

In digital banking, AI has gone beyond mere automation and is now helping with predictive analytics, personalized financial planning, fraud detection, credit risk assessment, and intelligent investment advisory services (Bashatweh, 2024). AI advisory systems can provide personalized investment recommendations in real-time based on structured and unstructured financial data, which encompasses market conditions, macroeconomic indicators, investor behavior, and portfolio performance (Olanrewaju, 2025).

Compared to a traditional advisory, AI systems provide significant analytical advantages as they are able to process large volumes of information quickly and efficiently and continually update predictive systems as more information becomes available. The aforementioned capabilities will help financial institutions deliver ever more personalized financial services based on investors' profile and their actions. As a result, AI in investment advice has enhanced portfolio optimization, customer engagement, and made financial services more accessible for various investor segments. While there are several behavioral and ethical considerations to take into account in the context of AI in financial advisory, these benefits do exist. Recommendation algorithms are generally based on past market trends and customer buying habits. However, if the data used in these systems is not accurate or there are systemic biases, AI systems can continue market trends or generate suboptimal investment suggestions. Also, if algorithms are not transparent, there is a risk of losing investors' trust and holding the algorithm accountable for the losses incurred. Hence, transparency, explainability, fairness, and continuous regulatory monitoring is crucial for good governance of AI. These factors can be applied to the design of an AI system to proactively detect and reduce behavioral risks before they happen, which can lead to improved investment results. These AI-driven systems, with their roots in behavior, can have the potential to enhance investor welfare while

maintaining a human touch in financial decision-making.

5.4 Algorithmic Recommendations and Personalized Investment Decisions

The algorithmic recommendation system is part of the digital financial services platforms, which enables financial institutions to provide individual investment recommendations to their customers as per their profile, transaction history, their investments portfolio and the market conditions. Algorithmic recommendation systems use artificial intelligence (AI), machine learning, and predictive analytics to analyse large volumes of financial data and generate investment recommendations aligned with investors' risk tolerance, financial objectives, and behavioural profiles (Olowe et al., 2024).

Compared with traditional advisory services, these systems enable faster, data-driven decision-making and can reduce emotional investing by promoting evidence-based recommendations, portfolio diversification, and long-term investment strategies (Kumari, 2024). However, they also introduce behavioural risks, including algorithmic bias, overreliance on automated recommendations, and the reinforcement of existing market biases (George, 2024)(Heo, 2025). To address these challenges, explainable AI (XAI) enhances the transparency and interpretability of algorithmic decisions, fostering investor trust, accountability, and informed decision-making, while supporting the development of more responsible digital investment systems.

5.5 Social Media Investing

The rise of social media has drastically changed the game in the realm of investment information, changing how the information is obtained, assessed and distributed by investors. Social media like X (formerly Twitter), Reddit, LinkedIn, YouTube, and specific investment forums enable the real-time sharing of monetary information, industry impressions, and investment methods. These platforms have made financial information accessible to everyone and provided them with greater opportunities for collaborative learning and peer-to-peer knowledge sharing. But social media has also emerged as a key investment behaviour motivator. When deciding on investments, investors turn to online forums, financial influencers and digital communities, and often times give weight to the group more than the numbers. This can lead to the formation of herd mentality, confirmation bias, and fear of missing out (FOMO), especially when the markets are uncertain or volatile, or when there has been a lot of activity. During events like the GameStop short squeeze, for example, social media's impact on investor behaviour was more pronounced because the activity of retail investors was able to significantly shift prices, even as there was not a lot of significant changes happening on the corporate level. Such events help to show the power of digital communication networks to magnify behavioural biases by allowing investors to follow crowd behaviour instead of financial analysis. Behavioural biases can also be reinforced by recommendation algorithms used by social media, which can push individuals to see content aligned with their past preferences and actions. This algorithm-driven echo chamber effect may also restrict to alternative ideas, can increase the probability of an investment "feel" being more extreme and can cause polarization of investment communities on the web. Social media thus makes money more available and information more shareable, but also provides spaces for behaviour that should be better understood and digital financial literacy needs to be increased.

5.6 Gamification of Digital Investment Platforms

Gamification is the use of elements of a game in a non-gaming context to improve engagement and motivation of users. In the world of digital banking and investment, gamification has become a growing trend in fostering engagement, educating customers about finance, and enhancing the overall user experience. As gamification can enhance customer engagement, it has been shown that investment systems based on games may be counterproductive to rational behaviour by studies of behavioural finance. Frequent notifications and colourful interface designs, reward mechanisms and instant

performance feedback can elicit emotional responses that mirror a gaming experience, instead of a disciplined approach to making financial decisions. These design features can encourage higher trading volume, investors' overconfidence, and short-term investing instead of investing for the long term. Furthermore, investing through a "gamification" approach may exacerbate sensation seeking by providing a false sense of competitiveness of financial markets, and an erroneous association between investing success and rapid decision-making and constant trading. Such a behavioural framing could cause misperceptions of risk in investments, and could increase the risk of loss aversion, overconfidence and availability bias.

On the contrary, if used with investor education, then responsible gamification can contribute to positive financial results. Disciplined investment behaviour may be encouraged by the challenges in the educational component, the financial literacy modules, the rewards for diversification of investment portfolios, and the long-term savings incentives, as well as the users' learning about financial risk. Therefore, the behavioural effects of gamification are highly dependent on the design of the platform, regulations, and the ethical use of motivational strategies.

5.7 Digital Nudging and Behaviourally Informed Financial Decision-Making

Digital nudging is one of the most exciting use cases in digital banking for the field of behavioural finance. Digital nudges are small tweaks to digital systems that steer users to a more desirable option without eliminating their autonomy of choice, based on principles from behavioural economics (Richard et al., 2022). Digital nudges do not change the choice of investments available, but they modify the presentation of the information leading to more rational financial actions. Digital nudges in digital banking can be as simple as reminders to diversify portfolios, to prompts to save in the long-term, to opt-out defaults on savings accounts, to personalized risk warnings, and to confirmation screens prior to undertaking high risk transactions (Das & Das, 2025). The interventions aim to decrease impulsive decision-making and to prompt investors to carefully consider financial consequences before making a decision. However, with the advent of new AI and behavioural analytics tools, financial institutions can tailor digital nudges to the behavioural characteristics, financial goals, and past behaviour of investors (Ashrafuzzaman et al., 2025).

Behaviourally adaptive digital interfaces can detect signs of emotional trading, over-concentrated portfolios, or quick and frequent speculative trading and then make specific suggestions to enhance the quality of decisions (Lim, 2026).

While digital nudges have significant potential, they also introduce some ethical questions. A high degree of personalization or manipulation of user interface could undermine the autonomy of the investor and lead him to select the products more suited for the commercial interests of the company, than for his economic interests. This makes transparency, fairness, informed consent and consumer protection principles more and more relevant for the implementation of the behaviourally informed digital intervention, which are increasingly put into focus by regulatory frameworks. In conclusion, the digital nudging approach shows the value of incorporating behavioural finance in digital banking to enhance the outcomes of investments while maintaining free choice. If used responsibly, digital nudges can limit the impact of cognitive biases, boost financial resilience and lead to more sustainable investment behaviour.

5.8 Synthesis

Digital banking has completely changed investor behaviour, changing the way financial information is accessed, interpreted and acted upon. Together, various technologies – including mobile banking, robo-advisors, artificial intelligence, algorithmic recommendation systems, social media platforms, gamified investment apps and digital nudging – have made financial services more accessible and personalized. However, these innovations have also changed the context in which investment decisions are made – their behavioural context – and thus provided an opportunity for cognitive bias amplification as well as rational decision support. Digital banking should not be considered

as just a techno-innovation but rather a behavioural ecosystem where the investor psychology and technological design are continuously interacting and impacting the financial decision-making. These interactions offer a crucial lens for creating digital financial systems grounded in ethical principles, transparency, and a behavioural approach that prioritizes long-term investor well-being.

6. How Digital Technologies Amplify or Mitigate Cognitive Biases

6.1 Information Overload

One of the biggest behavioral issues of online banking is information overload. The online investing tools today provide investors with up-to-date information on financial news, market indicators, analysts' reports, social media sentiment, forecasts about the economy, algorithmic recommendations, and real-time updates on one's portfolio. The more information to choose from the better the quality of the decision, but there is some behavioural research that suggests that too much information may have the effect of ruining human judgement (You et al., 2022). Information overload is the phenomenon that happens when the amount and complexity of information provided to a person is greater than can be processed (Stanley, 2021). Investors in such markets tend to make more non-rational decisions, potentially triggering common cognitive biases, such as availability bias, anchoring and confirmation bias. Investors might only take into account the information that they can obtain easily and that might appeal to them on an emotional level, and disregard the other information available to them (Sathya & Gayathiri, 2024).

In digital banking, this is amplified by constant notifications, real-time price changes, and alerts and tailored financial information. Investors may experience decision fatigue when grappling with the rapidly evolving information that is distributed via numerous digital mediums. Thus, too much information can lead to more uncertainty, emotional responses and impulsive trading behavior, which can hinder investment quality, rather than facilitate it. In financial services, intelligent information filtering, dashboard and simplified decision supporting interfaces can reduce the amount of information overload and highlight the relevant information, reducing the unnecessary cognitive load.

6.2 Automation Bias

Automation bias has been characterized as the over-reliance on automated systems and failures to critically evaluate independently (Romeo & Conti, 2026). In the digital banking landscape, automation bias has become more relevant as robo-advisors, algorithmic portfolio management tools, automated trading platforms and AI trading assistants are becoming more prevalent in investment strategies (Ajuwon et al., 2025). Automated investment systems offer many benefits, such as better analysis, lower operational expenses, better portfolio diversification, and more regular investment approaches (Wah, 2025). However, behavioural research suggests that investors don't really ask themselves whether the automated recommendations are right since they feel they are objective. Such dependence can cause investors to accept too much advice, particularly when markets fluctuate, making it less predictable when investors should accept or reject advice. For investors who lack financial expertise, automation bias can be a particular danger to algorithmic recommendation making as they may do the opposite of what they should (Enyiorji & Deloitte, 2023). Instead of using them to make informed decisions, investors might end up passively taking advice from an automated service. Therefore, the right mix of technology supports and human decisions is crucial to any successful digital banking. The creation of advisory tools based on AI should therefore be governed by the principles of using AI to encourage investors to be more actively involved with their investment rather than automating the decision-making process altogether, through clear explanations, transparency and independent evaluation.

6.3 Algorithmic Bias

Algorithmic Decision Making might appear to be objective and factual but does not necessarily mean a lack of bias. Algorithmic bias occurs when

the results of an AI system are systematically biased because the training data used to develop the system is biased, the system's model is poorly designed, there is missing data, or the optimization goal is poorly designed (Slussareff & O'Neil, 2022).

In digital investment platforms, algorithmic bias can impact portfolio suggestions, credit evaluations, risk profiling, and individualized investment approaches (Olanrewaju, 2025). AI systems can perpetuate existing biases in the market, such as those present in historical financial data, if these biases are not addressed. AI systems can also inadvertently reinforce market biases if they are not being addressed when they make recommendations for the future. For example, models that produce recommendations according to a large amount of past investor activity can go on producing investment recommendations based on overconfidence, herd mentality or confirmation bias. Other issues related to algorithmic bias are fairness, transparency, accountability and consumer protection (Bahangulu & Owusu-Berko, 2025). Consumers lack knowledge about the fundamental information regarding the mechanism behind the recommendation made by the AI models leading to information gaps between financial institutions and investors (Sifat, 2023). Consequently, regulators have increasingly turned their focus towards issues of algorithmic governance, independent auditing, the assessment of fairness and the development of ethical guidelines for AI to ensure responsible financial innovation (Oyasiji et al., 2023). To mitigate algorithmic bias, it is essential to use diverse and representative training data, regularly validate models, employ explainable AI methods, and maintain human oversight throughout the decision-making process (Mensah, 2023).

6.4 AI-Assisted Investment Decisions

Artificial Intelligence has revolutionized financial institutions' analytical capabilities, from predictive modelling to sentiment analysis, portfolio optimization, fraud detection, and personalized financial planning, all of which have been enhanced to a great degree (Paramesha et al., 2024). AI-driven investment platforms can quickly analyze both structured and unstructured financial data, uncover hidden market trends, and produce investment insights and recommendations based on data that surpass what's possible for humans to analyze on their own (Theodorakopoulos et al., 2025).

Behaviourally, AI provides a lot of promise for minimizing emotional investment decisions. Instead of fear, greed or cognitive short-cuts, machine learning algorithms assess the value of investment opportunities through objective, statistical models. AI systems can thus help to optimize portfolio diversification, promote long-term investment planning, and mitigate overconfidence and loss aversion-driven over-trading. However, AI should be treated as a decision-support tool, and not a tool to replace human decision-making. Political events, macroeconomic uncertainty, behavioural responses and unanticipated shocks affecting the financial markets continue to affect the financial markets. It is important therefore, that human interpretation is still needed to understand the algorithmic outputs in the larger context of economic and social factors. In the future, digital investment is expected to be a part of collaborative intelligence, where AI systems complement and complement human investment decisions.

6.5 Behavioural Interventions in Digital Banking

Recent developments in behavioural economics have resulted in a range of new behavioural measures to be added to digital banking, prompting financial institutions to adopt such measures. The advances in behavioural economics have also led financial institutions to consider introducing behavioural measures into their digital banking platforms. Behavioural interventions aim to make consumers behave in a rational way by altering the digital environment to stimulate rational behaviour without limiting consumer choice (Moustati et al., 2024) (Weintraub et al., 2021).

These range from portfolio diversification reminders, to investment goal trackers and the implementation of cooling-off periods before

carrying out high-risk transactions, risk warnings, automatic savings, personalized financial education modules, and much more. These interventions take a proactive approach to cognitive bias by offering encouragement to investors to think twice and look at other options before making investment decisions and to consider long-term financial goals. There is empirical evidence of the significant improvement in investor outcomes that can be achieved through relatively simple behavioural interventions that can curtail impulsive investor behaviour, raise the rates of saving, and enhance long-term investment discipline. Therefore, incorporating the principles of behavioural science into digital banking is a practical approach to the promotion of responsible financial behaviour, while maintaining individual autonomy.

6.6 Explainable Artificial Intelligence (XAI)

Transparency has become a major priority as AI increasingly plays a role in financial decisions, ensuring that investors have a clear understanding of the risks and opportunities involved, and that regulations are adhered to. Explainable Artificial Intelligence (XAI) is the ability of AI systems to provide understandable explanations of the reasoning behind the recommendations made, enabling the user to examine the logic behind the algorithm, rather than the results as a sort of "black box".(Chamola et al., 2023).

In digital banking, explainable AI can help investors make better decisions with greater confidence, by making their lives easier to understand what a digital bank is doing with its risk profiles, how it allocates funds, and how it makes investment recommendations. This transparency enables investors to question the outcomes of the algorithms that they are using, to compare various investment approaches and to make more informed financial decisions. Digital technologies offer great potential to improve investment decisions, but behavioural impacts vary and are context-specific. Digital technologies are dual natured and can either be designed to exacerbate cognitive biases or reduce behavioural limitations if they are designed responsibly and intelligently, as shown in figure 4.

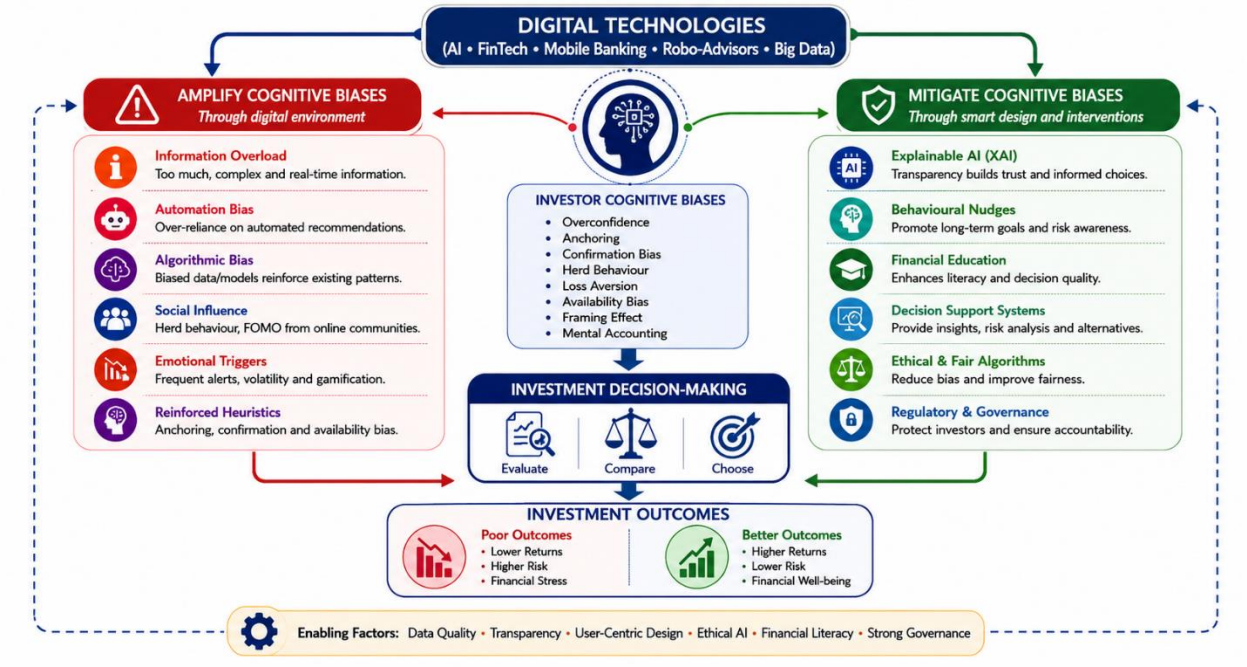


Figure 4. Dual Role of Digital Technologies in Investment Decision-Making

Dual role of digital technologies in investment decision-making. Digital banking technologies may either amplify behavioural biases through information overload and automation

dependence or mitigate them through explainable artificial intelligence, behavioural interventions, and transparent decision-support systems.

6.7 Synthesis

Digital technologies have revolutionised the way investors can access, share and analyse financial information. The advantages of AI, algorithmic recommendation systems and automated advisory products are that they make things more efficient and more inclusive, but they also come with behavioural issues, like information overload, automation bias and algorithmic bias. Behavioral interventions, explainable AI, and transparent algorithmic governance can help overcome these challenges and promote more rational investment decisions. Finally, the future of digital banking will rely as much on innovative technology as it will on the application of the principles of behavioural science, ethical AI and investor-centred design. Combining the principles of behavioural finance with digital innovation gives a holistic view for creating responsible financial systems. In Figure 5, we provide a more integrated framework that connects the various aspects of digital banking technologies, investor mindset, behavioural interventions, and sustainable investment outcomes. The interaction between digital technologies and investor psychology creates both behavioural opportunities and risks. While digital platforms can improve financial decision-making through automation, personalization, and data-driven insights, they may also intensify cognitive biases such as overconfidence, herd behaviour, and confirmation bias. Table 3 summarizes the major digital technologies, their associated behavioural risks, and potential mitigation strategies for promoting more responsible investment decisions.

Table 3. Digital Technologies, Behavioural Risks, and Mitigation Strategies

Digital Technology	Behavioural Risk	Cognitive Biases Influenced	Mitigation Strategy
Mobile Banking	Continuous market monitoring	Loss aversion, overconfidence	Portfolio summaries, long-term performance dashboards
Robo-Advisors	Excessive trust in automation	Automation bias	Human oversight, explainable recommendations
AI Advisory Systems	Opaque decision-making	Automation bias, confirmation bias	Explainable AI (XAI), transparent algorithms
Algorithmic Recommendations	Reinforcement of historical preferences	Confirmation bias, anchoring	Diverse recommendation models, periodic review
Social Media Investing	Peer influence and FOMO	Herd behaviour, availability bias	Investor education, misinformation detection
Gamification	Emotional and excessive trading	Overconfidence, sensation seeking	Responsible interface design, trading limits
Digital Nudging	Choice architecture manipulation	Framing effect	Ethical nudging, transparent disclosure
Big Data Analytics	Personalization reinforcing prior behaviour	Confirmation bias	Balanced information presentation, behavioural monitoring

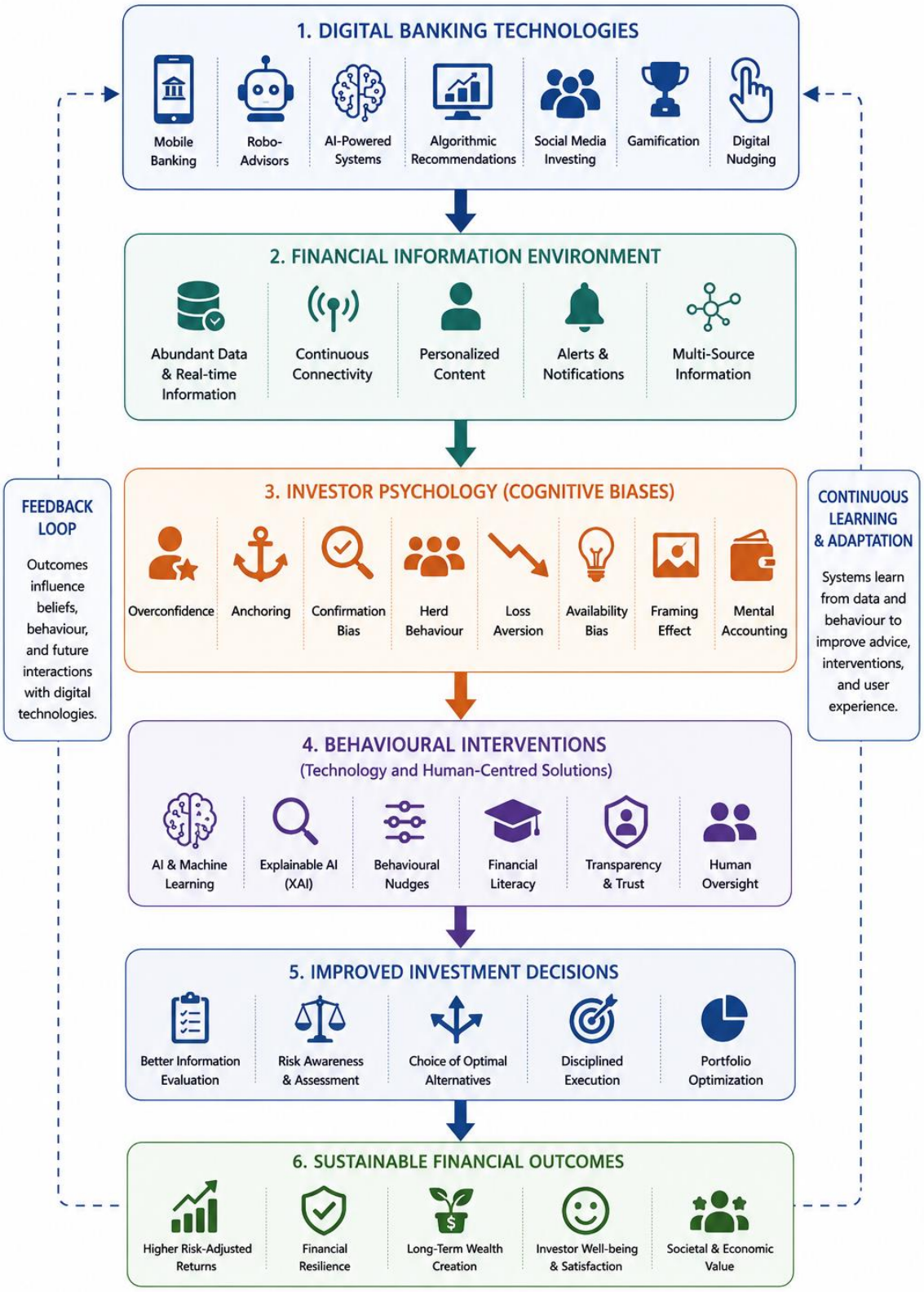


Figure 5. Integrated Framework for Behaviourally Intelligent Digital Banking

7. Regulatory, Ethical and Governance Implications

Digital banking, AI, and fintech innovations have revolutionized investment services, making them more efficient, accessible, and tailored to individual investors' needs. The developments, however, bring along regulatory and ethical issues concerning consumer protection, transparency of algorithms, data privacy, AI governance, financial literacy and sustainable finance. There is a need to take a comprehensive approach that combines technological innovation, behavioral finance concepts, ethical AI, and robust regulatory supervision. Consumer protection is a key regulatory focus, with digital investment platforms presenting retail investors to various risks, including information overload, misleading information, inappropriate algorithmic recommendations, and financial fraud (Baffour Gyau et al., 2025)(Packin et al., 2025). Behaviourally informed disclosures, such as simplified risk warnings and standardised investment information, can help to increase investor understanding and reduce cognitive biases. As AI-powered investment advice grows in popularity, transparency of algorithms has become a growing concern. Many of the recommendation systems are like 'black boxes' and investors have very limited idea on how the recommendations are being made. Explainable AI (XAI) can help solve this problem by making algorithmic decisions more interpretable, increasing investor confidence, holding institutions accountable and ensuring regulatory compliance (Chamola et al., 2023). To ensure the fairness and reliability of the tools, financial institutions should complement the use of XAI with algorithm audits and independent validation. Personalisation of financial services is also essential, with digital banking depending on customer data to personalise services, and data governance is also important. Effective governance structures are crucial when it comes to privacy and reducing cyber risks—from secure data handling to informed consent and adherence with data protection laws and regulations, to transparent data practices. Lastly, good AI governance is essential to responsible digital banking. Investment advice, credit scoring, fraud prevention, and portfolio management are among the different potential applications for AI that necessitate ongoing monitoring, bias evaluation, human oversight, and accountability to guarantee the algorithmic decisions are equitable, open, and meet regulatory obligations as well as consumer requirements.

Technological innovation to enhance investment outcomes must go hand-in-hand with an improvement in digital financial literacy. However, investment platforms are becoming more sophisticated and investors must be able to critically analyse financial information, understand the algorithmic recommendations, identify behavioural biases and be aware of investment risks. To address this, there is a need to shift the focus of financial literacy education programs from financial education to digital skills, such as responsible use of automated investment platforms, data privacy, cybersecurity, and understanding of AI. The need to create financial education programmes that are accessible and create investor resilience in the digital financial environment, in collaboration between governments, financial institutions and educational institutions. Financial institutions are now expected to go beyond profitability and to consider environmental, social and governance (ESG) issues when transitioning towards sustainable finance. Digital technologies and AI tools provide powerful analytical capabilities to integrate sustainability at the investment decision level, such as real-time ESG data analysis, climate risk analysis and portfolio building for sustainability. However, there can be behavioural biases as well in sustainable investment choices. There is a risk of ESG information being incomplete, investors possibly overreacting to information about ESG issues, and the risk of 'greenwashing', which is the addition of environmental performance. The need for the transparent reporting of ESG data, standardised disclosures on sustainability, and trustworthy analysis based on AI tools will be integral to encouraging informed decisions on sustainable investments. To wrap up, the next generation of digital banking will be governed and leveraged by technology advancements and strong governance

frameworks that must be built to be efficient, transparent, protect consumers, and avoid misuse of AI and ensure sustainable growth for financial institutions. A regulatory framework based on behavioural finance principles will facilitate responsible innovation, and boost investor confidence and financial stability, in the long-term.

8. Implications for Banks, Fintech Companies and Policymakers

The findings presented in this article have revealed that Investment in digital banking involves a decision-making process that is not only technologically innovative, but is also affected by behavioral and psychological factors. The strategy should be multi-faceted, combining technology development, ethical governance, consumer protection, and behavioural insights, and is a shared responsibility between financial institutions, fintech companies, and policymakers. This can enhance the investor returns and support financial stability, innovation and sustainable growth.

Digital platforms are not only transactional spaces but also environmental spaces – where investors act, process information and make financial decisions – that should be recognised by banks and fintech businesses (Nofsinger, n.d.). The design of platforms should therefore emphasize principles that focus on the user and facilitate the making of informed choices, rather than too much trading or impulsive or uninformed investment behaviour (Kulkarni et al., 2025). While AI and behavioural analytics can be useful in providing personalised investment advice, assessing portfolio risk and detecting cognitive biases, they should be used in conjunction with, not as a replacement for, human judgment (Gupta & Rao, 2025). In the future, financial institutions need to focus on explainable AI, transparent algorithms, and cybersecurity measures to foster investor confidence and compliance with regulations. Ensuring digital financial literacy is also relevant in technology-based financial markets (Koskelainen et al., 2023). Educational programmes need to go beyond principles of investment to include education on behavioural finance, AI and decision-making, cybersecurity, digital risk awareness and the ethical use of fintech services (Ahmed & Dwivedi, 2025). The incorporation of interactive tools and customised advice in digital banking can also help foster responsible long-term investment patterns. Digital platforms that promote rational investment decisions can also be designed using the principles of behavioural finance (Kulkarni et al., 2025). Portfolio diversification features, cooling-off periods on riskier investments, personalised risk alerts, and goal-based investing can help to curb impulsiveness, enhance investor independence and positively impact long-term investment returns (Nam et al., 2025). Therefore, effective consumer protection needs to go hand in hand with financial innovation. Priorities include promoting algorithmic transparency, explainable AI, cybersecurity, data protection, and regular audits of automated investment systems. Financing, technology, regulators and researchers must all work together to create both inclusive and transparent digital financial systems and resilient environments.

9. Future Research Directions

Digital banking and financial technologies keep evolving and changing the investor behaviour, which brings new opportunities and challenges for behavioural finance research. While there is a considerable amount of research into cognitive biases in traditional and digital investment settings, there are some newer technologies that are under-explored. Further studies should try to be interdisciplinary, combining finance, AI, behavioural science, computer science and public policy to gain more insight into the impact of technological innovation on financial decision-making.

Generative artificial intelligence (GenAI) is revolutionizing the financial advisory industry by offering investment advice through conversation, generating reports automatically, and providing customized financial planning (Saxena et al., 2024). GenAI can process complex financial data and deliver real-time explanations to individual investors, unlike traditional AI systems. Further studies could explore investor attitudes and

confidence in AI-driven financial recommendations, the impact of AI on cognitive biases, and the ethical considerations of AI tools and recommendations (Mabwe et al., 2025).

With behavioural analytics, financial institutions can apply transactional data, digital interactions, and real-time behavioural signals to better understand how investors make decisions. These methods can help identify cognitive biases early, enabling investment platforms to offer tailored interventions to promote more rational financial actions. Future research should be conducted to explore the efficiency of the behaviourally adaptive investment systems for different population segments and market environments, and privacy and informed consent issues. Digital twin technology is gaining momentum across industries, including manufacturing and the healthcare sector, and now it is starting to catch the eye in financial services. A digital twin can emulate an investor's financial profile, investment goals and risk appetite to test different investment strategies prior to implementation. Future studies could focus on the potential of digital twins for portfolio optimization, behavioural modelling, and financial risk management, as well as on the ethical and technical issues involved in digital twins. In recent years, there has been a growing trend of environmental, social, and governance (ESG) investing, which has gained significant traction in the financial world. ESG indicators are now increasingly present in the digital banking platforms in investment products, allowing the investor to integrate sustainability and financial performance. But behavioural biases can creep into ESG investment decisions by selective information processing, framing effects and being easily swayed by greenwashing. Further research should focus on the role digital technologies play on enhancing the transparency, credibility and behavioural efficiencies of sustainable investment decision-making.

Central Bank Digital Currencies (CBDCs) are emerging as a significant innovation in the global monetary system, with numerous central banks exploring or piloting digital currency initiatives (Lee et al., 2021). The advent of CBDCs could also impact consumer payment habits, savings trends and investment choices, and trust in financial institutions. Future research should explore the behavioural impacts of the introduction of a CBDC, including the role and influence of cognitive biases on the willingness of the public to adopt a CBDC-based payment system, financial inclusion, and investment decisions within the digital financial ecosystem (Pratiwi, 2024).

Open Finance is an extension of the open banking ecosystems to other financial services such as insurance, pensions, investments and wealth management (Khamitdkhanovich et al., 2025). Open Finance can improve personalisation and financial inclusion by enabling integration of financial services. However, increased data sharing also has issues of algorithmic bias, privacy, cybersecurity, and informed consent. Further studies are needed to explore the impact of Open Finance on investor behaviour and decision-making, as well as its implications for regulatory governance, while ensuring innovation and consumer protection. In conclusion, there is a need for future research to shift the focus from a technology-driven approach towards building a comprehensive framework that incorporates elements of behavioural finance, artificial intelligence, ethical governance, and digital innovation. This interdisciplinary work will be beneficial for building technologically sophisticated, rational, transparent and inclusive digital financial ecosystems.

10. Conclusion

Digital banking has revolutionized the investment landscape, making it more accessible, inclusive, and the use of innovative financial technologies more prevalent. Automated information, analysing investment opportunities and taking financial decisions have been revolutionised by the rise of mobile banking, fintech applications, artificial intelligence, robo-advisors, algorithmic recommendation systems, and open banking. These technological innovations have helped to shape a more streamlined, effective and customer-friendly financial landscape. But they have also brought about new behavioural issues that go beyond the tenets of conventional financial theory.

This article has shown that the rational choice theory is not enough to explain the investment decision-making in the digital banking environment. Behavioural finance offers an excellent theoretical framework for explaining how a cognitive bias, e.g. overconfidence, anchoring, confirmation bias, herd behaviour, loss aversion, availability bias, framing effects, or mental accounting, makes investors systematically deviate from rational decision making. Digital technologies may exacerbate or reduce these biases, depending on the design of digital platforms, transparency of algorithmic processes, and investors' financial literacy. One of the value-added aspects of this article is that it brings together the principles of behavioural finance and the latest advancements in digital banking. Research to date is largely focused on the technological, operational and financial aspects of digital banking but this article highlights that the investor's behaviour is still a key influencing factor in the financial decisions that are made in investment settings that are digitally enabled. Technological innovations like personalised recommendations, AI-powered advisory tools, social trading platforms, and behavioural nudges are increasingly influencing investor decisions, highlighting the need to consider the behavioural and ethical impact alongside efficiency and convenience.

Moreover, it underscores the importance of technology innovation and good governance to encourage responsible digital banking practices. Financial institutions need to focus on creating and implementing AI systems that are transparent, explainable, ethical, and that can support, but not replace, human decision-making. Using behaviourally-informed platform design, explainable AI, an investor education program and a robust cybersecurity framework can help to reduce and dampen irrational investment behaviour and enhance investor confidence. Regulators and policy makers also should establish adaptive governance mechanisms to make algorithms, consumer protection, data privacy and financial literacy accountability more effective in the digital space without limiting technological innovation. With the introduction and development of new technologies such as Open Finance, CBDs, digital twins, and behavioural analytics, investor attitudes and financial decision-making will be further impacted. Innovations offer great potential to enhance financial inclusion, personalisation and investment efficiency, but also have many complex regulatory, ethical and governance challenges. Researchers, financial institutions, technology developers, regulators and technology policy makers will need to work together in a sustained manner to support the development and progress of innovation, while ensuring regulatory safety and responsible governance. Ultimately, the future of digital banking lies in transparent, inclusive, behaviourally informed, and ethically governed financial systems. Integrating behavioural finance with digital technologies can foster resilient financial ecosystems that enhance investor welfare, market integrity, financial inclusion, and sustainable economic growth.

REFERENCES

Ahmad, M., & Shah, S. Z. A. (2022). Overconfidence heuristic-driven bias in investment decision-making and performance: mediating effects of risk perception and moderating effects of financial literacy. *Journal of Economic and Administrative Sciences*, *38*(1), 60–90.

Ahmed, W., & Dwivedi, Y. K. (2025). Advancing FinTech Fraud Literacy Through Intelligent User Awareness. *International Working Conference on Transfer and Diffusion of IT*, 226–242.

Ajuwon, A., Oladuji, T. J., Akintobi, A. O., & Onifade, O. (2025). AI-Powered Transformations in Financial Services: Automation and Innovation in Investment and Risk Models. *Engineering and Technology Journal*, *10*(6), 5397–5415.

Ashrafuzzaman, M., Parveen, R., Sumiya, M. A., & Rahman, A. (2025). AI-powered personalization in digital banking: A review of customer behavior analytics and engagement. *American Journal of Interdisciplinary Studies*, *6*(1), 40–71.

Awalakki, M., & Archanna, H. (2023). Overconfidence bias and its effects on portfolio decisions. *International Journal of Creative Research Thoughts*, *11*(8), 74–83.

Baffour Gyau, E., Li, Y., & Appiah, M. (2025). Global digital transformation: Discovering the impact of digitalization on income inequality in OECD countries, the moderating role of globalization. *Economic Change and Restructuring*, *58*(1), 6.

Bahangulu, J. K., & Owusu-Berko, L. (2025). Algorithmic bias, data ethics, and governance: Ensuring fairness, transparency and compliance in AI-powered business analytics applications. *World Journal of Advanced Research and Reviews*, *25*(2), 1746–1763.

Barile, D., Secundo, G., & Bussoli, C. (2025). Exploring artificial intelligence robo-advisor in banking industry: a platform model. *Management Decision*, *63*(10), 3323–3349.

Basharat, A., & Azmat, H. (2024). Revolutionizing Digital Banking: The Transformative Impact of Fintech Innovations. *Euro Vantage Journals of Artificial Intelligence*, *1*(2), 27–35.

Bashatweh, A. (2024). Role of Artificial Intelligence in Enhancing Strategic Decision-Making for Top Level Management Through Financial Analysis in Jordanian Commercial Banks. *International Journal of Technology Innovation and Management (IJTIM)*, *4*(2), 60–74.

Bhatt, A., Joshipura, M., & Joshipura, N. (2022). Decoding the trinity of Fintech, digitalization and financial services: An integrated bibliometric analysis and thematic literature review approach. *Cogent Economics & Finance*, *10*(1), 2114160.

Boot, A., Hoffmann, P., Laeven, L., & Ratnovski, L. (2021). Fintech: what's old, what's new? *Journal of Financial Stability*, *53*, 100836.

Botzen, W. J. W., Thepaut, L. D., & Banerjee, S. (2025). Kahneman's insights for climate risks: Lessons from bounded rationality, heuristics and biases. *Environmental and Resource Economics*, *88*(10), 2663–2688.

Chamola, V., Hassija, V., Sulthana, A. R., Ghosh, D., Dhingra, D., & Sikdar, B. (2023). A review of trustworthy and explainable artificial intelligence (XAI). *IEEe Access*, *11*, 78994–79015.

Das, T., & Das, S. (2025). The Impact of Innovative Digital Nudges by Financial Institutions on Customer Financial Decision-Making in Age of Fintech Disruption. *SURVIVING THE WAVE*, 62.

Demirgüç-Kunt, A., Klapper, L., Singer, D., & Ansar, S. (2022). *The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*. World Bank Publications.

Dordevic, F., Binkowski, E., & Claesson, E. (2026). *Individual Differences in Risk Propensity and Economic Decision-Making: A Study Integrating Prospect Theory and the DOSPERT Scale*.

Enyiorji, P., & Deloitte, L. (2023). Does widespread use of AI recommendation engines reduce consumer financial choice diversity. *International Journal of Science and Engineering Applications*, *12*(4), 163–173.

Gbanador, M. A. (2021). An Empirical Test for Semi-strong form Efficient Market Hypothesis of the Nigeria Stock Market. *Asian Journal of Economics, Business and Accounting*, *21*(23), 42–53.

George, A. S. (2024). Robo-revolution: Exploring the rise of automated financial advising systems and their impacts on management practices. *Partners Universal Multidisciplinary Research Journal*, *1*(4), 1–6.

Gulati, T., Singla, A., & Saini, P. (2026). Digital finance in the era of digital transformation: a bibliometric analysis and systematic literature review. *Digital Transformation and Society*, *5*(2), 145–169.

Gupta, S., & Rao, M. V. S. (2025). AI in Behavioral Finance: Understanding Investor Bias Through Machine Learning. *Journal of Informatics Education and Research*, *5*(2), 5870–5880.

Heo, W. (2025). Revisiting Algorithmic Bounded Rationality With Potential Solutions: How Recommendation Systems Amplify Cognitive Biases in Consumer Decision-Making. *Journal of Consumer Affairs*, *59*(4), e70032.

Höppner, M. (2026). Models in Decision-Making Under Risk and Uncertainty. *Journal of Economic Surveys*, *40*(1), 304–320.

Imade, O. (2024). Where Two Rivers Meet: A Complementary Approach to Behavioral and Classical Finance In Foreign Exchange Arbitrage. *Available at SSRN 4904265*.

Karki, U., Bhatia, V., & Sharma, D. (2024). A Systematic Literature Review on Overconfidence and Related Biases Influencing Investment Decision Making. *Economic & Business Review*, *26*(2), 130.

Khamitdkhanovich, N. A., Senthilkumar, C., Kavitha, V. O., & Ugli, E. R. S. (2025). The evolution of open banking: Transforming financial services with data-driven technologies. *AIP Conference Proceedings*, *3306*(1), 30026.

Koskelainen, T., Kalmi, P., Scornavacca, E., & Vartiainen, T. (2023). Financial literacy in the digital age—A research agenda. *Journal of Consumer Affairs*, *57*(1), 507–528.

Kubińska, E., Adamczyk-Kowalczuk, M., & Macko, A. (2023). *Behavioral finance in the digital era: saving and investment decisions*. Routledge.

Kulkarni, M. S., Patil, K. P., & Pramod, D. (2025). The role of robo-advisors in behavioural finance, shaping investment decisions. *Cogent Economics & Finance*, *13*(1), 2571403.

Kumari, S. A. I. (2024). Enhanced portfolio management: leveraging machine learning for optimized investment strategies in 2024. *J. Inform. Educ. Res*, *4*, 1487.

Lee, D. K. C., Yan, L., & Wang, Y. (2021). A global perspective on central bank digital currency. *China Economic Journal*, *14*(1), 52–66.

Lim, T. (2026). Emotion-Aware Decision Support System for Real-Time Financial Sentiment and Behavior-Based Trading Risk Advisory. *Journal of Behavioral Finance*, 1–24.

Liu, Q., Chan, K.-C., & Chimhundu, R. (2024). Fintech research: systematic mapping, classification, and future directions. *Financial Innovation*, *10*(1), 24.

Lo, M. (2022). Market efficiency hypothesis. In *Encyclopedia of finance* (pp. 937–943). Springer.

Mabwe, K., Aminu, N., Ivanov, S. H., & Dimov, D. (2025). Generative artificial intelligence chatbots in investment decision-making: a phantom menace or a new hope? *Foresight*, *27*(4), 820–863.

Mensah, G. B. (2023). Artificial intelligence and ethics: a comprehensive review of bias mitigation, transparency, and accountability in AI Systems. *Preprint, November*, *10*(1), 1.

Moustati, I., Gherabi, N., & Saadi, M. (2024). Leveraging the internet of behaviours and digital nudges for enhancing customers' financial decision-making. *International Journal of Computer Applications in Technology*, *74*(3), 208–221.

Mundial, B. (2022). The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19. *World Bank Group. Https://Doi. Org/10.1596/978-1-4648-1897-4*.

Nam, S., Jung, Y., & Hong, H. (2025). From Impulsive Investment to Mindful Decisions: Exploring Design Opportunities of AI-Mediated Interventions for Emotionally Biased Investors. *Companion Publication of the 2025 ACM Designing Interactive Systems Conference*, 374–378.

Nofsinger, J. R. (n.d.). FinTech as Behavioral Contagion Infrastructure: Digital Platforms and the Amplification of Risk. *Available at SSRN 6380703*.

Olanrewaju, A. G. (2025). Artificial intelligence in financial markets: Optimizing risk management, portfolio allocation, and algorithmic trading. *International Journal of Research Publication and Reviews*, *6*(3), 8855–8870.

Olowe, K. J., Edoh, N. L., Zouo, S. J. C., & Olamijuwon, J. (2024). Review of predictive modeling and machine learning applications in financial service analysis. *Computer Science & IT Research Journal*, *5*(11), 2609–2626.

Orzeszko, W., & Piotrowski, D. (2024). Prediction of robo-advisory acceptance in banking services using tree-based algorithms. *Plos One*, *19*(5), e0302359.

Osei, L. K., Cherkasova, Y., & Oware, K. M. (2023). Unlocking the full potential of digital transformation in banking: a bibliometric review and emerging trend. *Future Business Journal*, *9*(1), 30.

Oyasiji, O., Okesiji, A., Imediegwu, C. C., Elebe, O., & Filani, O. M. (2023). Ethical AI in financial decision-making: Transparency, bias, and regulation. *International Journal of Scientific Research in Computer Science, Engineering and Information Technology*, *9*(5), 453–471.

Packin, N. G., Kliger, D., Reichman, A., & Rabinovitz, S. (2025). Hooked and Hustled: The Predatory Allure of Gamblified Finance: Nizan Geslevich Packin, Doron Kliger, Amnon Reichman, Sharon Rabinovitz. *Columbia Business Law Review*, *2025*(1).

Pandey, A., Patel, D. K., Sahu, S. K., & Gupta, P. (n.d.). *Role of Digital Banking in Investors' Awareness and Investment Decision-Making*.

Paramesha, M., Rane, N., & Rane, J. (2024). Artificial intelligence, machine learning, deep learning, and blockchain in financial and banking services: A comprehensive review. *Machine Learning, Deep Learning, and Blockchain in Financial and Banking Services: A Comprehensive Review (June 6, 2024)*.

Peters, U. (2022). What is the function of confirmation bias? *Erkenntnis*, *87*(3), 1351–1376.

Pratiwi, E. N. (2024). The impact of central Bank digital currency (Cbdc) volatility on monetary policy efficiency in financial inclusion and investment. *Journal of Social and Economics Research*, *6*(2), 195–222.

Ranjan, R. (2025). Behavioural finance in banking and management: A study on the trends and challenges in the banking industry. *Asian Journal of Economics, Business and Accounting*, *25*(1), 374–386.

Richard, H., THALER, S., & Cass, R. (2022). *Nudge: Improving Decisions About Health, Wealth and Happiness*. Penguin Books.

Romeo, G., & Conti, D. (2026). Exploring automation bias in human–AI collaboration: a review and implications for explainable AI. *Ai & Society*, *41*(1), 259–278.

SAHU, J. (n.d.). *Behavioural Biases in Mutual Fund Investment Decisions*.

Sathya, N., & Gayathiri, R. (2024). Behavioral biases in investment decisions: An extensive literature review and pathways for future research. *Journal of Information and Organizational Sciences*, *48*(1), 117–131.

Saxena, A., Mahajan, J., & Verma, S. (2024). *Generative AI in Banking Financial Services and Insurance*. Springer.

Sifat, I. (2023). Artificial intelligence (AI) and retail investment. *Available at SSRN 4539625*.

Singh, D., Malik, G., & Jha, A. (2024). Overconfidence bias among retail investors: A systematic review and future research directions. *Investment Management & Financial Innovations*, *21*(1), 302.

Slussareff, M., & O'Neil, C. (2022). Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy. *Crown: New York, NY, USA*.

Stanley, O. E. (2021). Information overload: Causes, symptoms, consequences and solutions. *Asian Journal of Information Science and Technology*, *11*(2), 1–6.

Svoboda, A. (n.d.). *Behavioral Finance in the Age of Technology: The Evolving Biases of Modern Investors*.

Tahvildari, M. (2025). Integrating generative AI in Robo-Advisory: A systematic review of opportunities, challenges, and strategic solutions. *Multidiscip Rev*.

Thaler, R. (2022). *Misbehaving: The Making of Behavioral Economics. Translation from English*. Moscow: Bombora Publ.

Theodorakopoulos, L., Theodoropoulou, A., & Halkiopoulos, C. (2025). Cognitive bias mitigation in executive decision-making: A data-driven approach integrating big data analytics, AI, and explainable systems. *Electronics*, *14*(19), 3930.

Väisänen, V. (2025). *The impact of COVID-19 on a Finnish bank's service management*.

Vasileiou, E. (2021). Behavioral finance and market efficiency in the time of the COVID-19 pandemic: does fear drive the market? *International Review of Applied Economics*, *35*(2), 224–241.

Vilela, M. J., & Oluyemi, G. F. (2021). Utility theory. In *Value of Information and Flexibility: Making Decisions Under Uncertainties* (pp. 21–51). Springer.

Wah, J. N. K. (2025). AI-Powered Wealth Management: Transforming Financial Literacy, Personalized Investments, and Risk Assessment Through Robo-Advisors and Predictive Analytics for the Future of Finance. *Chinese Science Bulletin*, *70*(02), 4401–4420.

Weintraub, J., Cassell, D., & DePatie, T. P. (2021). Nudging flow through 'SMART'goal setting to decrease stress, increase engagement, and increase performance at work. *Journal of Occupational and Organizational Psychology*, *94*(2), 230–258.

Wesslen, R., Karduni, A., Markant, D., & Dou, W. (2021). Effect of uncertainty visualizations on myopic loss aversion and the equity premium puzzle in retirement investment decisions. *IEEE Transactions on Visualization and Computer Graphics*, *28*(1), 454–464.

Wexler, M. N., & Oberlander, J. (2021). Robo-advisors (RAs): the programmed self-service market for professional advice. *Journal of Service Theory and Practice*, *31*(3), 351–365.

You, S., Yang, C. L., & Li, X. (2022). Algorithmic versus human advice: Does presenting prediction performance matter for algorithm appreciation? *Journal of Management Information Systems*, *39*(2), 336–365.