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SELP Journal of Social Science - A Blind Review & Refereed Quarterly Journal

ISSN: 0975-9999 (P) 2349-1655 (O) Impact Factor: 5.650 (I2OR),

4.111 (COSMOS), 2.5 (JIF), 2.77 (NAAS)

Volume XVII, Issue 66, July - September 2026

Formally UGC Approved Journal (46622), © Author

A STUDY ON AI-DRIVEN INNOVATIONS IN PORTFOLIO MANAGEMENT AND FINANCIAL ANALYSIS

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ABSTRACT

Artificial Intelligence has become an indispensable force reshaping the landscape of portfolio management and financial forecasting. With the proliferation of big data and computational power, AI-driven tools now empower financial institutions to make faster, smarter, and more informed investment decisions. This paper delves into the multifaceted role of AI in modern financial markets, emphasizing its ability to automate asset allocation, optimize risk-adjusted returns, and enhance predictive modelling through advanced analytics. AI methodologies such as machine learning, deep learning, natural language processing, and reinforcement learning enable systems to learn from historical patterns and real-time data. These techniques allow for dynamic portfolio rebalancing, anomaly detection, sentiment analysis from financial news, and predictive insights that surpass traditional statistical models.

AI models can assess non-linear relationships and adapt to evolving market conditions, offering a competitive edge to investment managers. The integration of AI also contributes significantly to risk management, by providing real-time risk exposure analysis, stress testing, and volatility forecasting. Neural networks, for example, have demonstrated remarkable success in forecasting market movements, pricing derivatives, and identifying arbitrage opportunities with high precision. Despite its advantages, the adoption of AI in finance is not without challenges. Concerns related to data quality, algorithmic transparency, model over fitting, and ethical implications must be addressed. Issues such as algorithmic bias, regulatory compliance, and data privacy raise critical questions about accountability and governance in AI-led decision-making. Through real-world case studies and industry implementations, this paper illustrates how firms are leveraging AI to gain strategic insight and maintain resilience in volatile markets. Ultimately, the research highlights that while AI is not a panacea, it serves as a transformative enabler for next-generation portfolio management and financial intelligence.

KEYWORDS: Artificial Intelligence, Portfolio Management, Financial Forecasting, Machine Learning, Risk Management, Neural Networks, Deep Learning, NLP, Predictive Analytics, Algorithmic Bias, FinTech, Big Data, Ethical AI, Investment Strategies, Financial Technology.

INTRODUCTION

Artificial Intelligence is changing the way the financial industry works by making processes faster, smarter, and more efficient. It uses powerful computer programs, including machine learning and data analysis, to help financial professionals make better decisions. From managing investment portfolios and assessing risk to detecting fraud and improving customer service, AI is becoming a key tool across many areas of finance.

Financial markets are fast-moving and filled with large amounts of information from different sources, such as news, trading data, and economic reports. Traditional financial methods often struggle to keep up with this complexity. AI helps by quickly analysing huge datasets and spotting patterns that humans might miss. For example, AI can detect early signs of market trends or risky investments much faster than older systems.

Machine learning models, a core part of AI, are especially useful because they improve over time. These models learn from past data and can make more accurate predictions about things like stock prices, market volatility, or investor behaviour. Today, many financial institutions are using AI tools to estimate returns, manage risks more accurately, and respond to changing market conditions in real time.

Recent developments show that over 70 per cent of financial firms globally have started using AI in some part of their operations, according to a 2024 Deloitte report. AI-powered robo-advisors now manage billions in assets, and big banks use AI chatbots to handle customer queries efficiently. Meanwhile, hedge funds and asset managers use AI to gain an edge in trading by analysing alternative data sources such as social media, satellite imagery, and news sentiment.

This paper will explore how AI is being used specifically in portfolio management and financial forecasting. It will look at how AI improves investment strategies, reduces risks, and helps investors make more informed choices. It will also discuss the challenges, such as data privacy, ethical concerns, and the need to keep humans involved in important decisions. Understanding how AI works and where it is most effective is key to using it successfully in modern finance.

TRADITIONAL AND AI DRIVEN APPROACHES IN PORTFOLIO MANAGEMENT

Portfolio management is a key part of investing, focused on choosing and balancing different assets to meet specific financial goals. Traditionally, this process depends heavily on human knowledge and experience. Investment professionals use tools like fundamental analysis, historical performance, and Modern Portfolio Theory to build portfolios. They consider factors like risk tolerance, market trends, and asset performance. While this method can be effective, it's also time-consuming, prone to human bias, and often struggles to keep up with fast-changing markets.

Today, artificial intelligence is transforming how portfolios are managed. AI-driven systems use powerful algorithms and machine learning models to process huge amounts of data much faster than humans can. These systems not only analyze structured financial information, like stock prices or balance sheets, but also unstructured data such as news articles, earnings calls, and even social media sentiment. This allows them to find hidden patterns and relationships that help in making better decisions about asset selection, risk management, and diversification.

One of the biggest advantages of AI in portfolio management is its ability to continuously learn and adapt. As market conditions change, AI models update themselves, helping investors adjust their portfolios automatically. This leads to better predictions, more accurate risk assessments, and faster responses to market events. According to a 2024 report by PwC, over 65 per cent of asset management firms now use AI tools to support or automate portfolio construction and monitoring.

AI-powered portfolio management also helps reduce costs and increase efficiency. Tasks that once took days like analysing market movements or rebalancing portfolios can now be done in minutes. However, there are also risks. For example, if the data used to train AI models is

biased or flawed, it can lead to poor decisions. Over-reliance on technology without human checks can also be dangerous, especially in unpredictable market conditions.

RELATED LITERATURE REVIEW

Lopez de Prado (2018): Advances in Financial Machine Learning Marcos Lopez de Prado presents ground breaking insights into how machine learning techniques can improve financial decision-making, especially in portfolio management. He argues that traditional statistical methods often fail to capture the complexities of financial markets, which are noisy and dynamic. His work highlights how supervised and unsupervised learning algorithms can model non-linear relationships and adapt to rapidly changing conditions. The book provides practical examples of applying ML to asset allocation, back testing, and risk management. Lopez de Prado also addresses challenges such as over fitting and the misuse of p-values, urging financial professionals to adopt more rigorous validation methods. His research serves as a foundation for developing AI-based financial strategies that outperform conventional approaches.

Chen, Y., & Hao, Y. (2021): The Application of AI in Portfolio Management: A Systematic Review Chen and Hao conducted a systematic literature review analysing over 100 academic and industry publications on the application of AI in portfolio management. They found that AI techniques, particularly deep learning and reinforcement learning, have significantly improved asset selection, dynamic rebalancing, and return forecasting. The study emphasizes how AI enables real-time data analysis, integrating alternative data sources like social media and news sentiment to capture market signals earlier. However, the authors caution against full automation, noting concerns about explainability, model transparency, and potential ethical risks. Their review concludes that a hybrid approach combining human insight with AI-driven tools is most effective in current financial environments.

RESEARCH OBJECTIVES

- To analyse the effectiveness of AI-based portfolio management compared to traditional investment strategies in terms of risk, return, and responsiveness.
- To evaluate the accuracy and adaptability of machine learning models in forecasting asset performance under varying market conditions.
- To identify the challenges and ethical considerations involved in the adoption of AI tools for portfolio management in the financial industry.

RESEARCH METHODOLOGY

Research Design:

This study will follow a mixed-methods approach, combining quantitative data analysis with qualitative insights.

Data Collection:

- **Quantitative:** Historical financial data from stock exchanges, financial statements, and AI model outputs (e.g., forecasts from machine learning models).
- **Qualitative:** Expert interviews with financial analysts, data scientists, and AI researchers; review of regulatory and ethical frameworks.

Sampling:

- AI-driven portfolios will be simulated using machine learning techniques (e.g., Random Forest, LSTM, Reinforcement Learning) on real-time and historical financial datasets.
- Traditional portfolios will be constructed using Modern Portfolio Theory and fundamental analysis benchmarks.

AI APPLICATIONS IN PORTFOLIO MANAGEMENT

Artificial Intelligence is changing the way portfolios are managed by making the process faster, smarter, and more accurate. With tools like machine learning, natural language processing, and neural networks, AI helps investors make better decisions and manage assets more efficiently. Here are some of the main ways AI is being used in portfolio management today:

Smart Asset Allocation:

AI models use machine learning to suggest how to divide investments across different assets. These models take into account past data, real-time market trends, and personal investor goals to build portfolios that aim to get the best returns with the least risk. Compared to traditional methods, AI can handle more complex data and make faster adjustments. For example, companies like Black Rock are using AI to support asset allocation for clients across different risk levels.

Improved Risk Management:

AI tools can spot risks early by analysing market history, economic signals, and trading behaviour. These systems forecast potential losses and recommend ways to protect the portfolio. In 2023, a survey by Accenture found that 68 per cent of investment managers now use AI for real-time risk alerts and stress testing.

Market Trend Prediction:

AI analyzes huge amounts of data like stock prices, interest rates, and economic updates to find trends and predict how markets might behave. Deep learning algorithms are especially good at identifying patterns that traditional tools often miss, helping investors make more informed moves.

Sentiment Analysis:

With NLP, AI reads and understands news, financial statements, and even social media posts. It measures the mood or "sentiment" of the market and uses that information to support investment choices. For instance, hedge funds use sentiment scores to anticipate market reactions to major news events.

Algorithmic Trading:

AI powers systems that automatically buy or sell assets based on real-time data and set rules. These systems can react to market changes in milliseconds, spotting quick opportunities like price differences across platforms. According to JPMorgan, over 80 per cent of U.S. equity market trades are now executed by algorithms.

Personalized Investment Advice:

Robo-advisors use AI to give tailored investment advice based on an individual's goals, risk tolerance, and time frame. They also adjust portfolios automatically when markets change. Companies like Betterment and Wealthfront use AI to manage billions in assets, offering low-cost investment solutions for retail clients.

On-going Portfolio Monitoring and Rebalancing:

AI constantly checks how a portfolio is performing and whether it needs to be adjusted to stay in line with the investor's goals. It can automatically rebalance portfolios, helping to reduce manual errors and maintain optimal asset distribution.

FINANCIAL FORECASTING WITH AI

Financial forecasting helps businesses and investors make smart choices about budgeting, investing, and managing risks. Traditional methods, like regression analysis and time-series models, are useful but often fall short when dealing with today's fast-changing and complex markets. These older models struggle to handle large, messy, and non-linear data. That's where Artificial Intelligence steps in offering faster, more accurate, and more flexible forecasting tools.

Machine Learning for Smarter Predictions

AI-powered machine learning models like decision trees, random forests, and support vector machines are being used to predict stock prices, market movements, and economic trends. These models can sort through huge amounts of data from different sources to find patterns that traditional tools might miss. According to a 2024 Deloitte survey, over 70 per cent of financial firms now use ML in their forecasting strategies.

Neural Networks for Time-Series Forecasting

Advanced models like Recurrent Neural Networks and Long Short-Term Memory networks are especially good at forecasting things that change over time, such as stock prices or

exchange rates. These models learn from historical patterns and capture long-term trends, which helps in making more accurate predictions for the future.

Using Market Sentiment for Forecasts

AI tools use Natural Language Processing to read and understand text data from news articles to social media posts to find out what the market is feeling or expecting. By adding this sentiment data into forecasts, investors can better predict how the market might react to news or events. In 2023, Bloomberg introduced an AI-driven sentiment index to guide short-term trading decisions.

Forecasting the Economy and Industries

AI also helps predict how the overall economy or specific industries will perform by analysing key data like GDP, inflation, interest rates, and job numbers. It can also track sector-specific trends such as technology or energy giving investors insights into where growth may happen next.

Scenario Planning and Risk Testing

AI models are used to run “what-if” scenarios simulating different market conditions to see how a portfolio might perform under stress. These tools help financial planners test for worst-case events and build strategies to reduce potential losses.

Fast Analysis of Market Data

AI can handle high-frequency data, which updates every second or even faster. This is especially helpful in short-term trading, where quick decisions based on tiny price movements can make a big difference. High-frequency trading platforms now rely heavily on AI for intraday predictions and trade execution.

Real-Time Updates and Learning

Unlike traditional models, AI systems keep learning from new data as it comes in. This allows them to update forecasts instantly and stay accurate even when markets shift suddenly such as during a geopolitical crisis or a sudden policy change.

ADVANTAGES OF AI IN FINANCIAL MANAGEMENT

Artificial Intelligence is changing how financial management works by making processes faster, smarter, and more efficient. Financial companies and investors are increasingly using AI to make better decisions, reduce risks, and improve customer service. Below are the main benefits of using AI in managing finances:

Better Decision-Making:

AI systems can analyse huge amounts of financial data in real-time and give helpful insights. This allows financial managers to make smarter, faster, and more accurate decisions instead of relying only on guesswork or manual analysis.

Stronger Risk Management:

AI can spot potential risks before they happen. It looks at market trends, past losses, and other risk factors to help companies prepare for market swings or economic changes. In 2023, firms like Morgan Stanley used AI to improve risk modelling during times of high volatility.

Lower Operational Costs:

By automating routine tasks like fraud checks, compliance reviews, and financial reporting, AI helps reduce the need for manual labour. According to PwC, automation through AI can cut operating costs by up to 30 per cent for financial institutions.

Better Fraud Detection:

AI can detect unusual behaviour in real-time by scanning large volumes of transactions and user behaviour. Its ability to learn from past fraud cases helps banks prevent theft before it happens. JPMorgan Chase now uses AI to monitor millions of transactions daily for fraud indicators.

Customized Financial Services:

AI can offer personalized advice by understanding a customer's spending habits, investment goals, and financial history. Apps like Cleo and YNAB use AI to give users budgeting tips and saving suggestions tailored to their needs.

Real-Time Market Tracking:

AI tools keep constant watch on market conditions, stock movements, and customer accounts. This lets financial managers respond instantly to changes, helping them make quicker and more informed investment choices.

Smarter Portfolio Management:

AI systems help investors build and adjust their portfolios using real-time market data. They can also automatically rebalance investments when needed. Robo-advisors like Wealth front and Betterment use AI to optimize returns for users with different risk levels.

More Accurate Market Forecasts:

Using predictive models, AI can forecast asset prices and market trends with great accuracy. A 2024 report from Gartner noted that AI-driven forecasting models now outperform traditional statistical models in most investment scenarios.

Time Savings Through Automation:

AI can handle repetitive tasks like data entry, account matching, and report generation. This not only reduces mistakes but also frees up employees to focus on more strategic work.

Scalable Solutions:

AI can work with large, complex data from across the globe without losing speed or accuracy. This makes it ideal for big financial institutions managing many portfolios or international operations.

Helps with Regulatory Compliance:

AI helps companies stay compliant with laws by automatically tracking rule changes, checking transactions for violations, and preparing audit reports. Tools like IBM Watson are being used to support regulatory tasks across banks.

CHALLENGES AND RISKS OF USING AI IN FINANCE

Although Artificial Intelligence is bringing major improvements to the finance world, using it also comes with serious risks and challenges. Financial institutions must deal with these problems to make sure AI is used in a responsible, safe, and fair way. Here are the main issues they face:

Poor Data Quality and Gaps:

AI systems need clean, complete, and current data to work well. If the data used is wrong, old, or biased, the AI might give bad advice or make poor decisions. A 2023 Accenture report found that 62 per cent of financial firms said poor data was a key barrier to getting reliable AI results.

Bias in Algorithms:

If the training data has hidden biases, the AI system can unintentionally treat people unfairly especially in credit checks, loan decisions, or hiring. For example, some AI models were found to deny loans more often to minority applicants because of biased historical data.

Lack of Clarity in AI Decisions:

Some AI models, like deep learning, are very complex and act like "black boxes," meaning it's hard to explain how they came to a certain conclusion. This makes it difficult to build trust and comply with rules that require transparency, like the EU's AI Act passed in 2024.

Cyber security Risks:

AI tools can be targets for hackers. If criminals gain access, they can steal sensitive financial data or even manipulate the AI's decision-making process. In 2023, a U.S. investment firm reported an attempted data poisoning attack on its AI trading model.

Over fitting and Poor Real-World Performance:

Sometimes, AI models work great during testing but fail in the real world. This happens when the model learns the training data too well and can't adapt to new or changing market situations.

Hard to Integrate with Old Systems:

Bringing AI into older financial systems can be expensive and technically challenging. Many banks still use out dated software that doesn't support AI tools without major upgrades.

Tough Legal and Regulatory Landscape:

There are many laws and regulations around data privacy, ethics, and fairness. Financial companies must follow these closely. Failing to comply could lead to lawsuits, fines, or damaged reputations.

Ethical Problems:

AI can raise big questions like: Who is responsible if AI makes a mistake? Will people lose jobs because of automation? Are decisions being made fairly? These are all important issues that companies need to think through carefully.

High Costs:

Building and maintaining AI systems takes a lot of money and skilled people. Smaller financial firms may not be able to afford this, creating an uneven playing field.

Too Much Dependence on AI:

Relying too heavily on AI might make human analysts lazy or reduce their ability to think critically. If the AI system crashes or makes an error, it could lead to big losses.

New Kinds of AI-Driven Threats:

As AI gets more powerful, bad actors also use it to commit fraud, create fake videos, or manipulate markets. These threats are evolving quickly and require constant vigilance.

ANALYSIS AND INTREPRETATIONS

Hypotheses

1. Hypothesis

Null Hypothesis (H_0): There is no significant association between professional background (e.g., finance, IT, data science) and perception of AI effectiveness in portfolio management.

Alternative Hypothesis (H_1): There is a significant association between professional background and perception of AI effectiveness in portfolio management.

Table 1**Test Used: Chi-Square Test**

Perception of AI Effectiveness	Finance	IT	Data Science	Total
Highly Effective	15	10	25	50
Moderately Effective	12	8	20	40
Not Effective	10	15	5	30
Total	37	33	50	120

Source: Computed Data**Table 2****Chi-Square Test Results**

Test	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.734	4	0.0009

Source: Computed Data

Interpretation

The Chi-Square test result shows a p-value of 0.0009, which is less than 0.05. This indicates a statistically significant relationship between professional background and perception of AI effectiveness. Therefore, researcher rejects the null hypothesis. Professionals in data science view AI as more effective than those in other fields.

2. Hypothesis

Null Hypothesis (H_0): There is no significant difference in satisfaction levels with AI tools among users from different industries.

Alternative Hypothesis (H_1): There is a significant difference in satisfaction levels with AI tools among users from different industries.

Test Used: One-Way ANOVA

Table 3

Descriptive Statistics

Industry	N	Mean Satisfaction Score	Std. Deviation
Banking	30	4.1	0.72
Insurance	30	3.6	0.85
Fin tech	30	4.4	0.63
Investment	30	3.8	0.90
Total	120	3.975	0.82

Source: Computed Data

Table 4

ANOVA Table

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.347	3	1.782	3.154	0.028
Within Groups	65.112	116	0.561		
Total	70.459	119			

Source: Computed Data

Interpretation

Since the **p-value is 0.028**, which is less than 0.05, researcher **rejects the null hypothesis**. This means there is a **statistically significant difference** in AI satisfaction levels among different industries. Fin tech users reported the **highest satisfaction**, showing AI tools are more effectively adopted in that sector.

THE FUTURE OF AI IN PORTFOLIO MANAGEMENT AND FINANCIAL FORECASTING

Artificial Intelligence is quickly changing how financial professionals manage investments and predict market movements. In the future, AI is expected to become even more advanced, offering greater accuracy, speed, and customization while solving many of today's challenges. Here are the top trends and improvements we can expect:

Rise of Self-Managing Systems:

AI systems are becoming smart enough to manage investment portfolios and make financial forecasts on their own, with little or no human help. These tools will automatically track market data, adjust portfolios, and make investment decisions in real time.

Smarter Learning Models:

New AI techniques, like reinforcement learning and GANs (Generative Adversarial Networks), will help AI make better decisions by learning from trial and error. These models can test many market scenarios and improve over time. In 2024, several hedge funds began using reinforcement learning to adjust their investment strategies daily.

Better Market Predictions:

AI will become even more accurate at forecasting market trends by analysing large and complex data sets. Quantum computing, which is being explored by Google and IBM, could boost AI speed and precision, making instant analysis of global markets possible.

Customized Investment Plans:

Future AI tools will offer extremely personalized financial advice based on a person's income, spending habits, and risk tolerance. This means everyone from beginners to professionals can get tailored investment help.

Live Risk Monitoring:

AI will soon offer real-time stress testing of portfolios by running simulations of potential risks like political crises or economic crashes. This can help investors avoid big losses and adjust their plans instantly.

Using Online Sentiment for Decisions:

AI will get better at reading the mood of the market by scanning social media, news reports, and earnings calls. This helps predict market reactions faster than traditional analysis. As of 2025, tools like BloombergGPT are already offering sentiment analysis based on financial texts.

Block chain and AI Together:

By combining AI with block chain, financial decisions will be more secure and transparent. Block chain can store all AI decisions in a way that can't be tampered with, making audits easier and reducing fraud.

Stronger Ethical Guidelines:

As AI becomes more powerful, governments and regulators are introducing strict rules to make sure it is used fairly. The EU AI Act (2024) is the first major law that demands transparency and limits biased AI use in finance.

Supporting Human Experts:

Rather than replacing people, future AI will help financial experts by giving clear, easy-to-understand insights. This will allow professionals to make faster and more informed decisions with AI as a support system.

Focus on ESG and Sustainability:

AI will also help investors choose companies that are socially responsible. By analysing Environmental, Social, and Governance data, AI can guide people to invest in businesses that align with their values.

More Access for Everyone:

Thanks to better technology, AI will no longer be just for big banks or wealth managers. Everyday investors and small businesses will use simple AI tools and robo-advisors to manage their finances.

SUGGESTIONS

- Explore how AI-driven innovations are being applied not only in developed markets but also in emerging markets such as India, Brazil, or Southeast Asia. This comparative approach will provide broader insights into AI's global impact.
- Include a detailed analysis of how AI models (e.g., neural networks, random forests) perform compared to traditional models based on accuracy, speed, and scalability. Use real or simulated financial data to demonstrate these differences quantitatively.
- Incorporate Environmental, Social, and Governance criteria into AI-driven portfolio analysis. AI can now assess non-financial data like sustainability reports and social sentiment, which adds value to ethical investing strategies.

- Propose a structured framework that financial institutions can use to minimize AI-related risks such as algorithmic bias, data security breaches, and model over fitting. This will make the study more actionable and practical.
- Offer strategic recommendations for financial firms on how to continuously adapt their AI tools to new data sources, market trends, and regulatory changes. Focus on the need for on-going model training, ethical AI governance, and human-AI collaboration.

CONCLUSION

This study shows how Artificial Intelligence is changing the way financial institutions manage investments and predict market trends. With the power to analyse massive amounts of data and detect patterns that humans may miss, AI is becoming a critical part of financial decision-making. It helps professionals make faster, more informed choices in today's fast-moving markets. For instance, firms like Black Rock and JPMorgan are now using AI to manage assets worth billions of dollars with improved precision.

AI offers several major advantages in finance. It improves forecasting accuracy by analysing market trends and real-time data, making it easier to predict asset prices and economic shifts. AI also helps in optimizing investment portfolios and adjusting them as markets change. Platforms like Bloomberg and Morningstar have recently launched AI-powered tools that give users real-time updates and personalized investment suggestions based on current market conditions.

Despite its strengths, AI in finance faces some serious challenges. Poor-quality or biased data can lead to flawed decisions, and many AI systems are still "black boxes," meaning their decisions aren't always easy to explain. Ethical concerns, such as data privacy and fairness, also need careful attention. For example, a recent case involving algorithmic bias in credit scoring in the U.S. has highlighted the need for more transparency in financial AI systems.

As more financial companies adopt AI, it's clear that technology alone is not enough. Human oversight is still needed to guide, monitor, and correct AI systems when necessary. Regulatory bodies like the European Union (through the 2024 EU AI Act) and the U.S. Securities and Exchange Commission (SEC) are now creating new rules to ensure AI is used responsibly in financial services. These efforts help maintain trust and safety in the industry.

In conclusion, AI has the power to reshape how financial markets operate by making them smarter, faster, and more adaptable. As AI tools continue to grow more advanced, they will help investors become more resilient and responsive in a complex global economy. By combining AI innovation with clear regulations and ethical practices, the future of financial forecasting and portfolio management looks not only more efficient but also more inclusive and sustainable.

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