

Student scientific conference

The Role of Artificial Intelligence in Modern Financial Markets and Investment

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Table of Contents

Abstract	3
1.Theoretical Foundations of Artificial Intelligence in Financial Markets.....	4
1.1.The Concept of Artificial Intelligence and Its Development in the Financial Sector.	4
1.2.Applications of Artificial Intelligence in Financial Markets	5
1.3.The Impact of Artificial Intelligence on the Efficiency of Financial Markets	5
2.The Use of Artificial Intelligence in Investments and Risk Management.....	6
2.1 Artificial Intelligence in Investment Strategies	6
2.2 AI in Financial Risk Management	6
2.3 The Use of AI in Detecting Financial Fraud.....	7
3. Analysis of the Impact of Artificial Intelligence on Contemporary Financial Markets	8
3.1 Analysis of the Development of Algorithmic Trading in Global Financial Markets....	8
3.2 Analysis of AI Adoption in Financial Institution and the FinTech Sector	9
3.3 Analysis of the Effectiveness of AI-Based Investment Strategies.....	11
3.4 Analysis of Risks Associated with the Use of AI in Finance	11
Conclusions	13
List of references	13

Abstract

The financial sector is currently undergoing an unprecedented digital transformation, with artificial intelligence serving as the cornerstone of modern market operations and innovation. The article defines the evolving role of AI technologies, including machine learning and generative models, and examines their impact on the functioning of global financial institutions and investment processes. It presents an analysis of AI adoption within the banking and FinTech sectors, focusing especially on its contribution to risk assessment, portfolio optimization, and financial fraud detection. Particular attention is paid to the effectiveness of algorithm-based investment strategies and their impact on market stability in the face of new systemic risks and model opacity. The findings highlight the urgent need for the implementation of transparent regulatory frameworks and ethical governance principles to ensure the secure and sustainable integration of artificial intelligence into the global financial system.

Keywords: Artificial Intelligence; Financial Markets; FinTech Innovation; Risk Management; Financial Stability

Introduction

The modern global economy is at a turning point where traditional financial models are giving way to solutions based on advanced digital technologies. This process, driven by the Fourth Industrial Revolution, has made the financial sector a natural testing ground for artificial intelligence. In an era of increasing macroeconomic uncertainty and immense volatility in capital markets, the ability to rapidly process information and mitigate risk is becoming a key determinant of the success of financial institutions.

This article undertakes a multidimensional analysis of the role of artificial intelligence in shaping modern financial markets. Firstly, the technological foundations of AI are defined, and the historical evolution of its implementation is analyzed. Subsequently, the practical aspects of utilizing algorithms in investment strategies, as well as in risk management systems and fraud detection, are presented. Particular attention is paid to the FinTech sector, which, thanks to its flexibility, is redefining the standards of customer service and operational efficiency. The objective of this study is not only to present the benefits derived from this technology but also to identify regulatory barriers and systemic risks that may affect the stability of the global financial system in the coming years.

1. Theoretical Foundations of Artificial Intelligence in Financial Markets

1.1. The Concept of Artificial Intelligence and Its Development in the Financial Sector

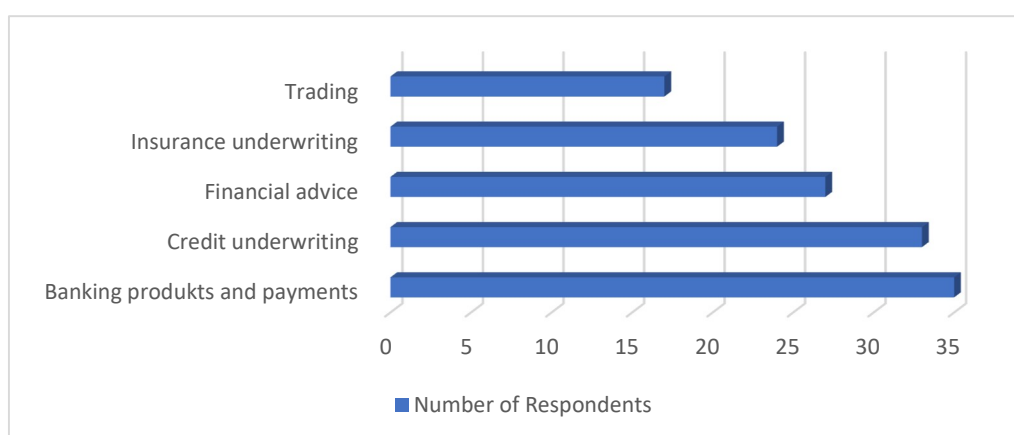
Artificial intelligence (AI) drives digital transformation in finance. It encompasses systems performing human-like tasks: data analysis, pattern recognition, learning, and decision-making under uncertainty. Development is fuelled by advances in computing power, big data, and machine learning.

Financial markets generate vast real-time data (transactions, prices, behavioural signals), where traditional methods often fail (BIS, 2025, pp. 1–2). Machine learning detects patterns in historical data for forecasting, pricing, portfolio optimisation, and algorithmic trading, while deep learning handles non-linear relationships and unstructured data (news, social media).

Combined with big data, AI provides competitive edges in credit scoring, fraud detection, automated trading, and portfolio management, boosting efficiency (McKinsey, 2025). It enables robo-advisory platforms that automatically build and rebalance portfolios by risk profiles and goals, increasing access but raising transparency, model risk, and stability concerns.

Surveys confirm AI's broad adoption across products and sectors (see Figure 1), with top uses in client communications, algorithmic trading, robo-advisory/asset management, surveillance/fraud detection, and anti-money laundering.

Figure 1. Most Frequently Cited Current and Near-Term AI Uses



Source: OECD (2024), *Regulatory Approaches to Artificial Intelligence in Finance*, p. 15.

1.2. Applications of Artificial Intelligence in Financial Markets

Artificial intelligence has become an integral part of modern financial markets, transforming trade execution, risk assessment, fraud prevention, and client services. Its impact goes beyond efficiency, influencing liquidity, information flows, and competition.

A key example is algorithmic trading, where machine learning analyses real-time data to identify patterns and execute trades within milliseconds. This improves liquidity and reduces spreads, although it may also increase short-term volatility (IOSCO, 2025). AI is also widely used in investment analysis and portfolio management, combining traditional and alternative data (e.g. social media) to improve forecasting and optimise portfolios (McKinsey, 2025).

In addition, AI supports robo-advisory platforms that automate investment decisions based on user profiles, increasing accessibility for retail investors. It also enhances risk management through improved credit scoring and early detection of market stress. In fraud detection and anti-money laundering, AI identifies complex anomalies more effectively than traditional systems. Finally, it improves client service and operations through chatbots and automation, reducing costs and increasing efficiency.

1.3. The Impact of Artificial Intelligence on the Efficiency of Financial Markets

The growing use of artificial intelligence has significantly improved the efficiency of financial markets, particularly in terms of information processing, price discovery, and transaction costs. AI systems analyse large volumes of structured and unstructured data in real time, enabling faster incorporation of information into asset prices and reducing arbitrage opportunities. In addition, algorithmic trading reduces transaction costs, increases liquidity, and enhances market accessibility.

However, the impact of AI is not exclusively positive. The widespread use of similar algorithms may lead to herding behaviour, increasing market correlations and amplifying volatility during periods of stress. Moreover, access to advanced AI technologies is uneven, potentially increasing information asymmetry between market participants. The complexity and limited transparency of AI models further create challenges for risk management and regulatory oversight.

2. The Use of Artificial Intelligence in Investments and Risk Management

2.1 Artificial Intelligence in Investment Strategies

In recent years, artificial intelligence (AI) has become one of the key tools used in financial markets. Its main advantage over traditional analytical methods lies in its ability to process vast amounts of data and identify complex patterns that are difficult for humans to detect. One of the most important applications of AI is “portfolio optimization”. Traditional approaches, such as the Markowitz portfolio theory, rely on simplifying assumptions and often fail to capture the dynamic nature of financial markets. Machine learning algorithms enable more flexible portfolio construction by incorporating a larger number of variables and capturing non-linear relationships between assets. Studies indicate that AI-driven strategies can improve the risk-return profile of portfolios, particularly in volatile market conditions.

Another important area is “data-driven investment models”. Modern investment strategies increasingly rely not only on structured financial data (e.g., financial statements, macroeconomic indicators) but also on unstructured data sources such as news articles, social media, and analyst reports. Natural Language Processing (NLP) techniques allow for sentiment analysis, which helps assess market expectations and investor behavior. Research shows that incorporating textual data can significantly enhance predictive performance in financial models.

AI is also widely used in “forecasting market trends”. Advanced models, including recurrent neural networks such as Long Short-Term Memory (LSTM), are applied to time series analysis to predict asset prices, volatility, and market movements. Although financial markets remain inherently uncertain, AI-based models improve short-term forecasting accuracy and enable faster responses to market changes.

2.2 AI in Financial Risk Management

Risk management is a fundamental component of financial decision-making, and AI significantly enhances its effectiveness by providing more accurate and adaptive analytical tools. In the area of “credit risk analysis”, traditional scoring models are increasingly being replaced by machine learning techniques such as random forests and gradient boosting. These models can incorporate a wider range of variables, including behavioral and alternative data, leading to more precise assessments of creditworthiness. Empirical studies show that AI-based credit scoring models outperform traditional statistical methods in predicting default risk.

AI also plays a critical role in “market risk forecasting”. Machine learning models can better capture extreme events and non-linear dependencies, which are often overlooked by classical risk models. This improves the estimation of key risk measures such as Value at Risk (VaR) and Expected Shortfall. Research suggests that AI-enhanced models provide more robust risk estimates, especially during periods of financial stress.

Another important application is “systemic risk monitoring”. AI enables the analysis of complex networks of financial institutions and capital flows, helping identify potential threats to financial stability. Network-based models and anomaly detection techniques are increasingly used by regulators and central banks to detect early warning signals of systemic crises.

2.3 The Use of AI in Detecting Financial Fraud

Artificial intelligence has significantly improved the effectiveness of financial fraud detection systems, which are essential for maintaining the integrity of financial systems.

In **fraud detection systems**, AI analyzes large volumes of transactional data in real time to identify unusual patterns and anomalies. Unsupervised learning techniques, such as clustering and autoencoders, are particularly effective in detecting previously unknown fraud schemes. According to industry reports, AI-based systems can substantially reduce false positives while increasing detection rates.

AI is also widely used in **anti-money laundering (AML)** processes. Financial institutions employ machine learning algorithms to monitor transactions and identify suspicious activities and relationships between entities. Network analysis techniques enable the detection of complex laundering structures that would be difficult to uncover using traditional rule-based systems.

In the field of **financial transaction analysis**, AI allows for automated classification of transactions based on risk levels. This improves operational efficiency by enabling institutions to focus on high-risk cases, reducing manual workload and response times. As a result, AI contributes to both cost reduction and enhanced security in financial operations.

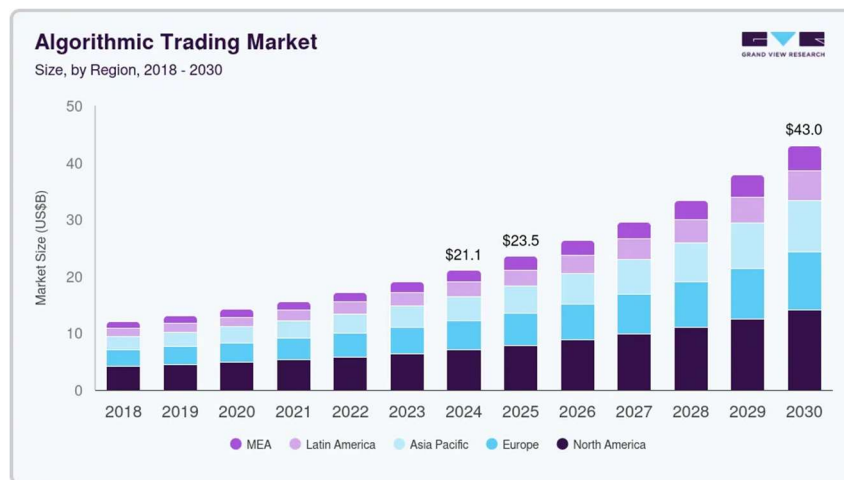
3. Analysis of the Impact of Artificial Intelligence on Contemporary Financial Markets

3.1 Analysis of the Development of Algorithmic Trading in Global Financial Markets

Algorithmic trading has become a key component of modern financial markets and has significantly transformed how trading activities are conducted. It refers to the use of computer algorithms to automatically execute trades based on data and predefined rules. Its rapid development has been driven by technological progress, increased data availability, and the growing use of artificial intelligence (AI).

In recent years, algorithmic trading has expanded significantly across global markets. According to the International Monetary Fund, it accounts for around 70% of equity trading and more than half of futures trading in the United States, highlighting its dominant role in advanced financial systems. Similar trends are observed in other regions, confirming that financial markets are gradually shifting toward automated and data-driven trading.

Figure 2. Algorithmic Trading Market Size by Region, 2018–2030



Source: Grand View Research (2024), *Algorithmic Trading Market Size, Share & Trends Analysis Report, 2023–2030*.

As shown in Figure 2, the global algorithmic trading market has been steadily growing and is expected to expand further in the coming years. North America remains the largest market, while Europe and Asia-Pacific also demonstrate strong growth. The forecast shows that the

market size may reach approximately \$43 billion by 2030, which confirms its strong future growth potential and the increasing importance of algorithmic trading worldwide.

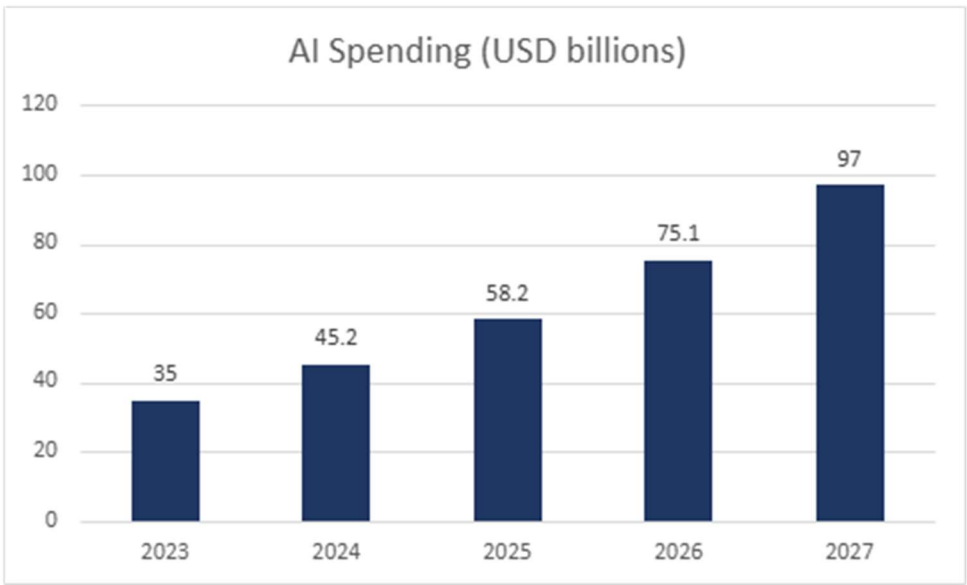
The integration of AI has further accelerated this development. Modern trading systems are able to process large volumes of data and react quickly to market changes, improving price discovery and overall market efficiency. At the same time, algorithmic trading increases liquidity and reduces transaction costs.

However, the growing reliance on algorithmic systems also creates risks. Algorithms may behave similarly during periods of market stress, which can amplify volatility. In addition, financial markets become more dependent on technology and large market participants.

3.2 Analysis of AI Adoption in Financial Institutions and the FinTech Sector

Technological development, whose dynamics have intensified since 2020, is increasingly influencing the financial sector. Banking and investment institutions, as well as fintech companies, have begun to use artificial intelligence (AI) as a tool to improve decision-making processes, customer service, and risk management. New technologies, including generative artificial intelligence, enable the analysis of vast datasets and the automation of tasks that previously required the involvement of specialists. The ongoing digitalization of financial services is leading to a profound transformation of the sector, in which the role of humans is gradually evolving toward supervising algorithm-based processes (International Monetary Fund, 2024, pp. 18–21).

Figure 3. AI Spending Forecast in the Financial Sector (USD billions)



Source: Own elaboration based on World Economic Forum (2025) and International Data Corporation (IDC) (2025), *Worldwide Artificial Intelligence and Generative AI Spending Guide*.

Contemporary financial institutions are investing significant resources in the development of predictive and generative AI systems. As illustrated in Figure 3, global investments in artificial intelligence show a strong upward trend; from a level of USD 35 billion recorded in 2023, they are projected to increase to USD 97 billion by 2027 (World Economic Forum, 2025, p. 5). This technology is applied in credit risk analysis, accounting data processing, investment portfolio optimization, and fraud detection. Moreover, it enables the dynamic generation of reports, interpretation of non-financial data, and personalization of offerings, thereby improving the quality of customer service.

The process of implementing artificial intelligence in financial services is evolutionary and multi-layered. Initially, the focus was on simple applications such as chatbots and anti-fraud systems; however, there is currently a gradual shift toward complex decision-making models and agent-based management systems. AI is also increasingly used in regtech, i.e., regulatory compliance, as well as in data analytics and risk management. As a result, financial institutions are better able to detect systemic threats and respond to them in real time (WEF, 2025, pp. 11–15).

In the long term, responsible implementation of artificial intelligence remains a key challenge. These risks primarily concern data protection, cybersecurity, and model transparency. A lack of oversight and standardization may lead to excessive concentration of technological risk and dependence of the financial sector on a few key technology providers (WEF, 2025, pp. 15–17). Therefore, increasing attention is being paid to the development of international regulatory frameworks ensuring transparency, auditability, and the ethical use of algorithms.

Artificial intelligence plays an increasingly important role in the transformation of financial institutions and the fintech sector. On the one hand, it enables significant improvements in operational and strategic processes; on the other, it generates new risks and complex challenges for regulators. Further development in this area will depend on the balance between innovation and technological responsibility, as well as on the ability of institutions to integrate AI in a secure, transparent, and ethically compliant manner.

3.3 Analysis of the Effectiveness of AI-Based Investment Strategies

AI-based investments have become one of the key drivers of modern capital markets. Algorithms utilizing machine learning and generative models enable the analysis of vast financial and macroeconomic datasets, resulting in more accurate forecasts and faster, more precise strategic decisions. These systems incorporate not only quantitative data but also unstructured information, such as market news, social media sentiment, and corporate reports. As a result, AI enhances analytical efficiency, improves forecast accuracy, and supports more effective portfolio risk management (International Monetary Fund, 2024, pp. 22–25).

Companies using AI-based analytical tools for risk forecasting and market exposure management tend to achieve superior performance and respond more rapidly to changes in asset prices and liquidity conditions. AI-driven investment models contribute to increased market efficiency and stability; however, they also introduce greater complexity into analytical processes. A key limitation is the lack of full transparency of algorithms, as well as the risk of feedback loops—when multiple institutions rely on similar models, their decisions may reinforce one another and lead to sudden market fluctuations (World Economic Forum, 2025, pp. 15–17).

The long-term effectiveness of AI-based investment strategies depends on several critical factors, including data quality, model transparency, and the balance between automation and human judgment. While AI significantly enhances decision-making capabilities, it should be treated as a support tool rather than a full replacement for human expertise. Sustainable competitive advantage in financial markets can only be achieved through the integration of expert knowledge with advanced computational capabilities.

3.4 Analysis of Risks Associated with the Use of AI in Finance

The increasing use of artificial intelligence (AI) in financial markets creates not only opportunities but also significant risks. As AI systems become more advanced and widely adopted, they may affect market stability and introduce new systemic vulnerabilities.

One of the main risks is the potential increase in market volatility. AI-based trading systems often rely on similar data and models, which may lead to herding behavior during periods of market stress. According to the International Monetary Fund, such synchronized reactions can amplify price movements and lead to sudden market fluctuations.

Another important issue is the lack of transparency of AI models. Many systems operate as “black boxes,” making it difficult to understand how decisions are made. This creates challenges for both risk management and regulatory supervision. At the same time, financial institutions are becoming increasingly dependent on external technology providers, which increases operational and concentration risks.

In addition, the use of AI may increase exposure to cyber threats and market manipulation. Advanced technologies can be misused to exploit data or influence market behavior. Therefore, the risks associated with AI are not only technological but also structural.

In addition to general financial risks, recent analysis highlights specific challenges related to generative AI, such as herding behavior, market concentration, and model explainability issues. These factors may further increase systemic risk and reduce transparency in financial markets. The main risks associated with the use of AI in finance are summarized in Table 1.

Table 1. Key Risks Associated with the Use of AI in

Risk Category	Description	Potential Impact
Market volatility	Similar AI reactions (herding)	Price instability
Market concentration	Dominance of large firms and vendors	Systemic risk
Model opacity	Lack of explainability (“black box”)	Low transparency
Operational risk	Dependence on external providers	System failures
Cyber risk	Increased exposure to cyber threats	Financial losses
Market manipulation	AI misuse and data exploitation	Market fragility

Source: own elaboration based on IMF (2024)

The risks presented in Table 1 show that the increasing use of AI in finance is closely linked to both technological and systemic challenges. While AI improves efficiency and market performance, its widespread adoption may create new vulnerabilities, especially during periods of market stress. Therefore, effective regulation and proper risk management are essential to ensure financial stability.

Conclusions

The analysis conducted in this article allows for the formulation of several key conclusions regarding the role of artificial intelligence in modern financial markets. First and foremost, AI technology has ceased to be merely operational support, becoming a strategic element in building a competitive advantage in the banking and FinTech sectors. Its implementation significantly increases the efficiency of decision-making processes, enables precise service personalization, and redefines risk management and fraud detection mechanisms.

Despite the evident benefits, the mass adoption of algorithms generates new, previously unknown systemic challenges. The lack of model transparency, the risk of technological concentration among a few providers, and the possibility of herding effects among investment algorithms pose a real threat to the stability of the global financial system. The remedy for these turbulences should be the introduction of coherent, international regulatory frameworks and ethical standards that will ensure the transparency and auditability of AI systems. In conclusion, the success of the digital transformation of the financial sector will depend on maintaining a balance between technological innovation and responsible oversight, allowing for the secure integration of AI into the architecture of modern markets.

List of references

1. World Economic Forum (WEF). (2025). Artificial Intelligence in Financial Services. White Paper, in collaboration with Accenture.
2. Cazzaniga, M., Jaumotte, F., Li, L., Melina, G., Panton, A.J., Pizzinelli, C., Rockall, E. & Tavares, M.M. (2024). Gen-AI: Artificial Intelligence and the Future of Work. IMF Staff Discussion Note SDN/2024/001. International Monetary Fund, Washington.
3. Bank for International Settlements (BIS). (2025). *Artificial Intelligence in Finance: Developments and Implications*. Basel.
4. Grand View Research. (2024). *Algorithmic Trading Market Size, Share & Trends Analysis Report, 2023–2030*.
5. International Data Corporation (IDC). (2025). *Worldwide Artificial Intelligence and Generative AI Spending Guide*.
6. International Organization of Securities Commissions (IOSCO). (2025). *The Use of Artificial Intelligence in Financial Markets*. Madrid.
7. McKinsey & Company. (2025). *The State of AI in Financial Services*.

8. OECD. (2024). *Regulatory Approaches to Artificial Intelligence in Finance*. Paris: OECD Publishing.