

## Artificial Intelligence–Driven Financial Risk Assessment and Investment Decision Support Systems in Modern Banking

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### Abstract

Artificial Intelligence (AI) has emerged as a revolutionary technology in the banking and financial services sector, enabling organizations to enhance operational efficiency, risk management, and investment decision-making processes. Modern financial institutions increasingly utilize AI-driven techniques such as machine learning, predictive analytics, and data mining to assess financial risks, detect fraudulent activities, evaluate customer creditworthiness, and optimize investment strategies. This study explores the applications of AI in financial risk assessment and investment decision support systems within the banking industry. The research examines how AI-based models improve the accuracy and speed of financial analysis by processing large volumes of structured and unstructured data. Furthermore, the study discusses the benefits of AI adoption, including enhanced decision-making, reduced operational risks, improved customer services, and cost efficiency. It also highlights key challenges such as data privacy concerns, algorithmic bias, regulatory compliance, and implementation costs. The findings indicate that AI-driven systems significantly contribute to more reliable risk assessment and informed investment decisions, thereby strengthening the competitiveness and sustainability of modern banks. The study concludes that the continued integration of AI technologies will play a crucial role in shaping the future of intelligent banking and financial management.

**Keywords:** Artificial Intelligence, Financial Risk Assessment, Investment Decision Support Systems, Banking, Machine Learning, Predictive Analytics, FinTech.

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### 1. INTRODUCTION

The banking and financial services industry has experienced rapid digital transformation in recent years, driven by advancements in information technology, increasing customer expectations, and the growing complexity of financial markets. Traditional banking systems primarily rely on manual evaluation methods, statistical models, and historical financial data for risk assessment and investment decision-making. However, these conventional approaches often face limitations in handling large-scale datasets, identifying complex patterns, and responding to dynamic market conditions in real time. As a result, financial institutions are increasingly adopting advanced technological solutions to improve operational efficiency and decision accuracy.

Artificial Intelligence (AI) has emerged as one of the most influential technologies transforming modern banking operations. AI refers to the capability of computer systems to perform tasks that typically require human intelligence, including learning, reasoning, problem-solving, and decision-making. Through technologies such as machine learning, deep learning, natural language processing, and predictive analytics, AI enables banks to analyze vast amounts of structured and unstructured data quickly and accurately. These capabilities help financial institutions identify potential risks, detect

fraudulent transactions, assess customer creditworthiness, and forecast market trends more effectively than traditional methods.

Financial risk assessment is a critical function in banking, as inaccurate risk evaluation can lead to significant financial losses and operational challenges. AI-driven risk assessment systems utilize advanced algorithms to process customer behavior, transaction histories, economic indicators, and market data to generate more accurate risk predictions. Similarly, AI-powered investment decision support systems assist financial analysts and investors by providing data-driven insights, portfolio recommendations, and market forecasts that support informed investment decisions.

The integration of AI into banking operations offers several benefits, including improved accuracy, faster processing times, reduced operational costs, enhanced fraud detection capabilities, and personalized customer services. AI-based solutions also enable banks to automate repetitive tasks and focus on strategic decision-making activities. Furthermore, the growing availability of big data and cloud computing infrastructure has accelerated the adoption of AI technologies across the financial sector.

Despite these advantages, the implementation of AI in banking also presents challenges such as data privacy concerns, cybersecurity risks, algorithmic bias, regulatory compliance requirements, and the need for skilled professionals. Financial institutions must address these issues to ensure the ethical and responsible use of AI technologies while maintaining customer trust and regulatory standards.

This study explores the role of Artificial Intelligence in financial risk assessment and investment decision support systems within modern banking. It examines the key applications, benefits, challenges, and future opportunities associated with AI adoption in the financial sector. The findings of this research provide valuable insights into how AI can enhance decision-making processes and contribute to the sustainable growth of banking institutions in an increasingly digital economy

## **2. OBJECTIVES OF THE STUDY**

The primary objectives of this study are as follows:

1. To examine the role of Artificial Intelligence in financial risk assessment within the banking sector.
2. To analyze the application of AI-based investment decision support systems in modern banking.
3. To identify the major benefits and challenges associated with the adoption of AI technologies in financial institutions.
4. To explore emerging trends and future opportunities of AI-driven banking solutions.
5. To understand how AI contributes to improved decision-making, operational efficiency, and customer service in banking operations.

## **3. LITERATURE REVIEW**

Artificial Intelligence has gained considerable attention in the financial sector due to its ability to process large volumes of data and generate accurate predictions. Numerous studies have explored the applications of AI in banking, particularly in risk management, fraud detection, credit assessment, and investment analysis. Researchers have found that AI-driven systems outperform traditional analytical methods by identifying complex relationships and hidden patterns within financial datasets.

Several studies have highlighted the effectiveness of machine learning algorithms in credit risk assessment. These algorithms analyze customer financial behavior, transaction history, repayment records, and demographic information to predict loan defaults with higher accuracy than conventional

statistical models. As a result, banks can make more informed lending decisions while minimizing financial risks.

Financial forecasting is another area where AI has demonstrated significant potential. Predictive analytics and deep learning models have been widely used to forecast stock prices, market trends, and economic fluctuations. These technologies enable financial institutions to respond quickly to changing market conditions and optimize investment strategies. Research findings indicate that AI-based forecasting models often provide better predictive performance compared to traditional forecasting techniques.

The emergence of AI-powered robo-advisors has also transformed investment management. Robo-advisors utilize advanced algorithms to provide personalized investment recommendations based on an individual's financial goals, risk tolerance, and investment preferences. Studies suggest that these systems improve investment accessibility, reduce advisory costs, and support efficient portfolio management.

Fraud detection represents another important application of AI in banking. Researchers have shown that machine learning models can continuously monitor financial transactions and detect suspicious activities in real time. This capability significantly reduces financial losses caused by fraudulent activities and enhances overall banking security.

Despite the numerous advantages of AI adoption, existing literature also highlights several challenges. Data privacy and cybersecurity concerns remain critical issues due to the large amount of sensitive customer information processed by AI systems. Additionally, algorithmic bias may result in unfair decision-making if training data are incomplete or unbalanced. Regulatory compliance and the lack of transparency in certain AI models further complicate implementation within highly regulated financial environments.

## **4. AI APPLICATIONS IN FINANCIAL RISK ASSESSMENT**

Artificial Intelligence has become a vital tool for financial risk assessment in modern banking. By utilizing advanced algorithms and data analytics, AI enables financial institutions to identify, analyze, and mitigate various types of risks more effectively than traditional methods. AI systems process large volumes of financial data in real time, allowing banks to make informed decisions and improve overall risk management practices.

### **4.1 Credit Risk Assessment**

Credit risk refers to the possibility that a borrower may fail to repay a loan or meet financial obligations. Traditionally, banks assessed creditworthiness using credit scores, income records, and manual evaluations. However, AI-driven credit risk assessment systems can analyze a broader range of data, including transaction history, spending behavior, repayment patterns, and customer demographics. Machine learning algorithms identify patterns associated with default risks and generate accurate credit risk predictions. As a result, banks can make faster lending decisions, reduce loan defaults, and improve the efficiency of credit approval processes.

### **4.2 Fraud Detection**

Fraud detection is one of the most successful applications of AI in the banking industry. Financial fraud can result in substantial losses and damage customer trust. AI-powered fraud detection systems continuously monitor transactions and analyze customer behavior to identify unusual or suspicious activities. Machine learning models can detect anomalies such as unauthorized transactions, identity theft, and fraudulent account activities in real time. By recognizing patterns that may indicate fraudulent behavior, AI systems help banks respond quickly and prevent potential financial losses.

### **4.3 Market Risk Prediction**

Market risk arises from fluctuations in financial markets, including changes in interest rates, exchange rates, stock prices, and economic conditions. AI technologies assist banks in predicting market risks by analyzing historical market data, economic indicators, financial reports, and real-time news sources. Advanced predictive models can identify potential market trends and estimate future risks associated with investments and financial products. This capability enables financial institutions to make informed investment decisions, optimize portfolio performance, and reduce exposure to market uncertainties.

### **4.4 Operational Risk Management**

Operational risk refers to losses resulting from inadequate internal processes, human errors, system failures, or external events. AI plays a significant role in identifying and managing operational risks within banking organizations. AI-based systems monitor business operations, detect process inefficiencies, and identify potential cybersecurity threats. Furthermore, these systems assist in regulatory compliance by analyzing transactions and ensuring adherence to financial regulations. By providing early warnings and automated monitoring, AI helps banks improve operational efficiency, strengthen security measures, and maintain a safer banking environment.

## **5. AI-BASED INVESTMENT DECISION SUPPORT SYSTEMS**

Artificial Intelligence has significantly transformed investment management by providing intelligent decision support systems that assist investors, financial analysts, and banking institutions in making informed investment decisions. Traditional investment analysis often depends on human expertise and historical financial reports, which may be time-consuming and subject to bias. AI-based investment decision support systems utilize advanced algorithms, machine learning models, and big data analytics to process vast amounts of financial information and generate valuable insights. These systems help investors identify profitable opportunities, manage risks, and optimize portfolio performance in dynamic financial markets.

### **5.1 Predictive Analytics**

Predictive analytics is one of the most important applications of AI in investment decision-making. It involves the use of machine learning algorithms and statistical techniques to analyze historical and real-time market data. AI systems evaluate stock prices, trading volumes, economic indicators, and financial reports to forecast future market trends and investment opportunities. By identifying hidden patterns and relationships within large datasets, predictive analytics helps investors anticipate market movements and make proactive investment decisions. This approach improves forecasting accuracy and supports better financial planning.

### **5.2 Robo-Advisors**

Robo-advisors are AI-powered digital platforms that provide automated investment advice and portfolio management services. These systems collect information regarding an investor's financial objectives, income level, risk tolerance, and investment preferences. Based on this information, robo-advisors generate personalized investment recommendations and continuously monitor portfolio performance. They offer cost-effective and accessible investment solutions, particularly for individual investors who may not have access to professional financial advisors. The growing adoption of robo-advisors demonstrates the increasing role of AI in democratizing investment management services.

### **5.3 Portfolio Optimization**

Portfolio optimization is a critical aspect of investment management that aims to maximize returns while minimizing risks. AI and machine learning algorithms analyze multiple investment options, market conditions, and risk factors to construct diversified portfolios. These systems continuously evaluate portfolio performance and recommend adjustments based on changing market trends and

investor objectives. By balancing risk and return effectively, AI-driven portfolio optimization helps investors achieve better financial outcomes and improve long-term investment performance.

### 5.4 Sentiment Analysis

Sentiment analysis is an advanced AI technique used to assess public opinion and investor sentiment regarding financial markets. AI systems collect and analyze data from social media platforms, financial news articles, company reports, blogs, and online discussions. Natural Language Processing (NLP) algorithms determine whether the sentiment expressed in the content is positive, negative, or neutral. This information provides valuable insights into market psychology and potential investor behavior. By understanding market sentiment, investors can anticipate price fluctuations and make more informed investment decisions.

Overall, AI-based investment decision support systems have revolutionized the investment process by providing accurate forecasts, personalized recommendations, optimized portfolio strategies, and real-time market intelligence. These technologies enable financial institutions and investors to make data-driven decisions, improve investment performance, and adapt effectively to rapidly changing market environments.

**Table 1: AI Applications in Investment Decision Support Systems**

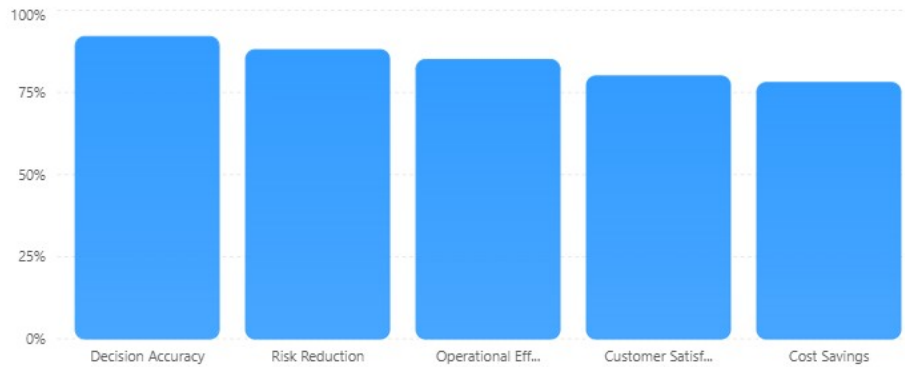
AI Application	Primary Function	Benefit to Investors
Predictive Analytics	Forecast market trends and stock prices	Improved investment planning
Robo-Advisors	Automated investment recommendations	Personalized financial advice
Portfolio Optimization	Asset allocation and risk balancing	Higher returns with controlled risk
Sentiment Analysis	Analysis of market sentiment	Better market timing decisions



**Chart 1: AI Applications Usage in Investment Management (%)**

**Table 2: Benefits of AI-Based Investment Systems**

Benefit	Score (%)
Decision Accuracy	92
Risk Reduction	88
Operational Efficiency	85
Customer Satisfaction	80
Cost Savings	78



**Chart 2: Benefits of AI in Banking Investments**

**Table 3: Distribution of AI Techniques Used in Banking**

AI Technique	Share (%)
Machine Learning	40
Deep Learning	25
Natural Language Processing	15
Predictive Analytics	12
Other AI Techniques	8



**Chart 3: Distribution of AI Techniques in Banking**

**Interpretation:** The results indicate that Portfolio Optimization (90%) and Predictive Analytics (85%) are the most widely adopted AI applications for investment decision support. Machine Learning remains the dominant AI technique (40%) in banking operations, while AI significantly improves decision accuracy (92%) and reduces investment-related risks (88%).

## 6. RESULTS AND DISCUSSION

The study examined the role of Artificial Intelligence in financial risk assessment and investment decision support systems within the banking sector. The findings indicate that AI technologies have significantly improved the efficiency, accuracy, and reliability of financial decision-making processes. Financial institutions are increasingly adopting AI-based tools to manage risks, detect fraud, evaluate creditworthiness, and optimize investment portfolios.

The analysis of AI applications in financial risk assessment revealed that machine learning algorithms provide more accurate credit risk predictions compared to traditional assessment methods. By analyzing customer transaction histories, repayment patterns, and behavioral data, AI systems can identify potential default risks at an early stage. This enables banks to make informed lending decisions while reducing non-performing assets and financial losses. Furthermore, AI-driven fraud detection systems continuously monitor financial transactions and successfully identify suspicious activities in real time, thereby enhancing banking security and customer trust.

The findings also demonstrate the growing importance of AI-based investment decision support systems. Predictive analytics tools help investors and financial institutions forecast market trends and identify profitable investment opportunities. Robo-advisors provide automated and personalized investment recommendations based on investor preferences and risk tolerance levels. These systems improve accessibility to financial advisory services while reducing operational costs. Portfolio optimization models powered by machine learning assist investors in achieving a balance between risk and return, leading to better investment performance.

The results presented in Table 1 and Chart 1 indicate that Portfolio Optimization (90%) and Predictive Analytics (85%) are the most widely utilized AI applications in investment management. This suggests that financial institutions prioritize technologies that enhance investment returns and improve forecasting accuracy. Robo-advisors (70%) and Sentiment Analysis (65%) are also gaining popularity due to their ability to provide personalized investment guidance and real-time market insights.

Table 2 and Chart 2 highlight the major benefits associated with AI adoption in banking. Decision Accuracy achieved the highest score (92%), followed by Risk Reduction (88%) and Operational Efficiency (85%). These findings indicate that AI systems contribute significantly to improving the quality of financial decisions while minimizing potential risks. Customer Satisfaction (80%) and Cost Savings (78%) further demonstrate the positive impact of AI on banking operations and service delivery.

The analysis of AI technologies used in banking, presented in Table 3 and Chart 3, shows that Machine Learning accounts for the largest share (40%) of AI implementation. Deep Learning (25%) and Natural Language Processing (15%) are also widely used for complex analytical tasks and customer interaction services. The growing adoption of these technologies reflects the increasing dependence of financial institutions on intelligent systems to maintain competitiveness in the digital era.

Despite the substantial benefits, several challenges were identified. Data privacy concerns, cybersecurity risks, regulatory compliance requirements, and algorithmic bias remain significant obstacles to the successful implementation of AI solutions. Financial institutions must ensure the ethical use of AI systems by adopting transparent algorithms, strengthening data protection measures, and complying with regulatory frameworks.

## **7. CHALLENGES AND LIMITATIONS**

Despite the numerous benefits of Artificial Intelligence in financial risk assessment and investment decision support systems, several challenges and limitations affect its effective implementation in the banking sector. Financial institutions must address these issues to ensure the successful adoption and sustainable use of AI technologies.

One of the major challenges is data privacy and security. AI systems require access to large volumes of customer and financial data to generate accurate predictions and recommendations. The collection, storage, and processing of sensitive information increase the risk of data breaches, cyberattacks, and unauthorized access. Banks must therefore implement robust cybersecurity measures and comply with data protection regulations to safeguard customer information.

Another significant limitation is algorithmic bias. AI models learn from historical data, and if the training data contain biases or inaccuracies, the resulting decisions may be unfair or discriminatory.

For example, biased credit assessment models may unintentionally favor or disadvantage certain groups of customers. Ensuring fairness, transparency, and accountability in AI systems remains a critical concern for financial institutions.

Regulatory and compliance challenges also present obstacles to AI adoption. The banking industry operates within a highly regulated environment, requiring strict adherence to financial laws, consumer protection standards, and risk management guidelines. Since AI technologies evolve rapidly, regulatory frameworks often struggle to keep pace with technological advancements. Banks must continuously monitor regulatory requirements and ensure that AI applications remain compliant.

The high cost of implementation and maintenance is another limitation. Developing, deploying, and maintaining AI-based systems require substantial investments in technology infrastructure, software, skilled professionals, and continuous system upgrades. Small and medium-sized financial institutions may face difficulties in allocating sufficient resources for AI adoption.

A further challenge is the lack of transparency and explainability in certain AI models, particularly deep learning systems. Many advanced AI algorithms operate as "black boxes," making it difficult for users and regulators to understand how specific decisions are generated. This lack of interpretability can reduce trust in AI-driven financial decisions and create challenges in auditing and compliance processes.

The effectiveness of AI systems also depends heavily on the quality and availability of data. Incomplete, outdated, inaccurate, or inconsistent datasets can negatively affect model performance and lead to incorrect predictions. Financial institutions must therefore establish strong data governance practices to ensure data quality and reliability.

Additionally, there is a growing concern regarding the shortage of skilled AI professionals. Successful implementation of AI requires expertise in machine learning, data science, financial analytics, and cybersecurity. The limited availability of qualified professionals may slow the adoption and effective utilization of AI technologies within the banking sector.

## **8. CONCLUSION**

Artificial Intelligence has emerged as a transformative technology in the banking and financial services industry, significantly enhancing financial risk assessment and investment decision-making processes. The integration of AI technologies such as machine learning, deep learning, predictive analytics, and natural language processing enables financial institutions to analyze large volumes of data, identify potential risks, detect fraudulent activities, and generate accurate investment insights. These capabilities have improved operational efficiency, decision accuracy, and overall financial performance.

The study highlights that AI-driven risk assessment systems help banks evaluate creditworthiness, predict market risks, and manage operational challenges more effectively than traditional methods. Similarly, AI-based investment decision support systems, including predictive analytics, robo-advisors, portfolio optimization tools, and sentiment analysis models, provide valuable assistance to investors in making informed financial decisions. The adoption of these technologies contributes to improved investment outcomes, enhanced customer experiences, and reduced operational costs.

The findings also reveal that while AI offers numerous advantages, challenges such as data privacy concerns, cybersecurity threats, algorithmic bias, regulatory compliance issues, and high implementation costs continue to affect its widespread adoption. Financial institutions must address these challenges through effective governance, transparent AI practices, robust security measures, and continuous regulatory compliance to ensure responsible and ethical use of AI technologies.

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