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The role of artificial intelligence in financial decision-making: Opportunities and risks

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Abstract---Recent years have seen a remarkable development of AI in finance, and the rise of AI-based tools and algorithms in financial decision-making signals a technological revolution in the financial industry that presents both enormous potential opportunities and serious risks. This paper aims to present a segment on artificial intelligence and highlight its potential uses in financial decision-making and associated risks. The study found that AI is instrumental in financial decision-making through the increased and informed use of AI-powered tools in the development of potential risk models, Predictive analysis, portfolio composition with a good investment mix, which facilitated managers' task in making financial decisions and the emergence of some challenges related to its risks that require reduction in the future.

Keywords---artificial intelligence; machine learning; finance; financial decisions.

INTRODUCTION:

In recent years, there has been a significant advancement in the field of technology and digital transformation. Within this context, artificial intelligence (AI) has emerged as a pivotal modern science, offering a wide array of services across various sectors, including finance. Despite the exponential growth in data availability within the financial sector, this abundance does not necessarily simplify financial decision-making. On the contrary, it can complicate the process, as the sheer volume of data exacerbates the problem of information overload that decision-makers must navigate. Therefore, financial decision-making requires concise, accurate, and unbiased information. Given the complexity and critical importance of extracting relevant insights from large

datasets, AI technologies have become instrumental due to their design for data-rich environments and their substantial potential to enhance financial decision-making. Based on the above, the central research question is posed as follows:

How do AI technologies contribute to supporting financial decision-making, and what are the main challenges faced by financial institutions when decisions are based on AI?

1. Definition of Artificial Intelligence:

Although artificial intelligence has been in existence since 1955 and its applications have proliferated in recent years, establishing a unified definition remains challenging due to varying perspectives on what AI encompasses. Several definitions exist, among which the following stands out:

Artificial intelligence is defined as a branch of computer science aimed at developing machines capable of performing tasks that require human intelligence. This includes learning, reasoning, pattern recognition, language understanding, and perception. Over the decades, the concept of AI has evolved from simple software to the advanced systems we observe today ([Razzaq, 2024, p. 203](#)).

Artificial intelligence (AI) is defined as a set of theories and algorithms that enable computer systems to perform tasks that typically require human intervention, such as speech recognition or text interpretation, and sometimes enhance the performance of these skills ([Fernandez, 2019, p. 01](#)).

Considering current applications, AI can be defined as systems that employ techniques in place of human involvement, capable of collecting data and utilizing it to predict, recommend, or make decisions across various fields, with differing levels of autonomous control.

2. Types of Artificial Intelligence:

- Narrow AI: This type of AI is designed to perform a single specific task or a limited set of tasks and lacks the ability to operate beyond those tasks. Examples include systems used in speech or image recognition.
- General AI: This represents a more advanced evolutionary stage where a machine can perform any task with efficiency comparable to or exceeding human capability. However, this form of AI remains in its early developmental stages ([Razzaq, 2024, p. 203](#)).

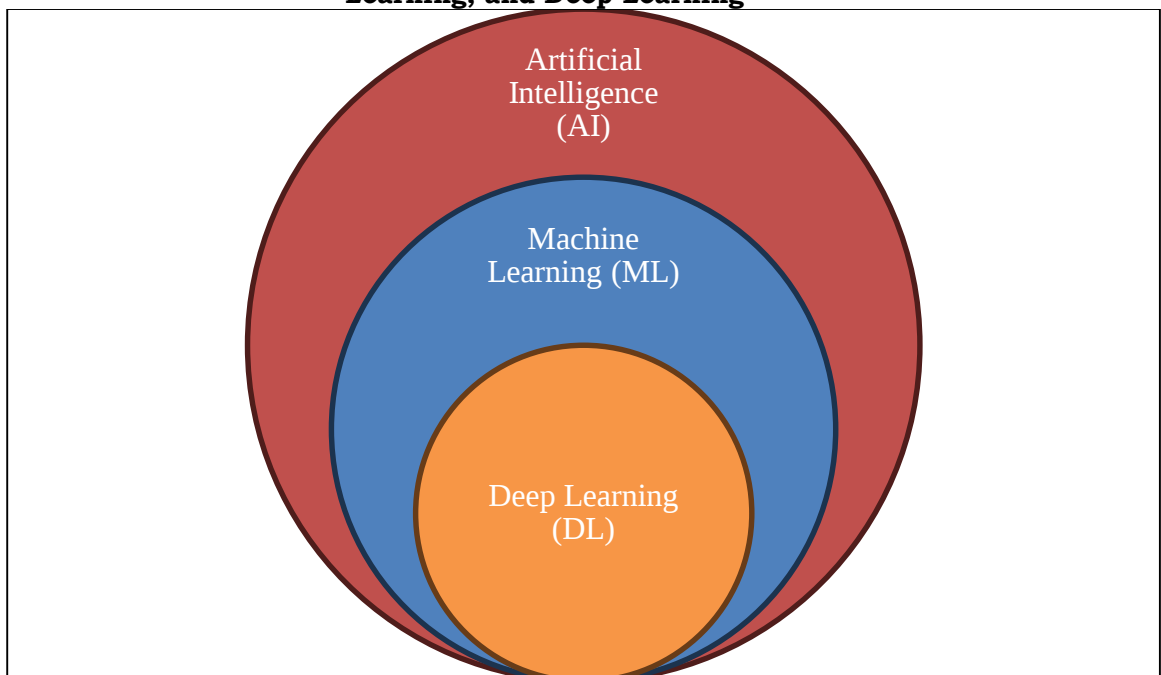
3. AI Technologies and Tools:

Artificial intelligence employs a range of advanced techniques to simulate human capabilities in information processing and decision-making. The primary technical approaches that enable these systems to perform complex tasks include rule-based AI, machine learning, deep learning, and neural networks.

- Rule-Based AI: This is the oldest form of AI, which does not learn from past experiences over time. Its knowledge and problem-solving abilities depend entirely on pre-defined rules, making it rigid and limited.
- Machine Learning: A type of AI that learns from big datasets using statistical tools and solves problems using algorithms without having to write code. Search engines, spam email filters, and online shopping recommendation systems are some of the most well-known examples of these algorithms.

- Deep Learning: Deep learning is a subset of machine learning that employs multilayer neural networks, known as deep neural networks, to analyze multiple levels of features within data. This approach enables systems to recognize complex patterns and make decisions with accuracy approaching that of humans, making it highly suitable for applications such as natural speech recognition, computer vision, machine translation, and autonomous vehicles (Ashta & Herrmann, 2021, p. 213).
- Neural Networks: Serving as the foundation for many artificial intelligence applications, particularly deep learning, these networks consist of units (nodes) that mimic the way the human brain processes information. The nodes are interconnected in a manner that allows the strengthening or weakening of signals based on the data received, enabling the system to learn and progressively enhance its performance (Razzaq, 2024, p. 203).

Figure 01: The Relationship between Artificial Intelligence, Machine Learning, and Deep Learning



Source: Prepared by the researcher based on (Ashta and Herrmann, 2021).

4. Characteristics of Artificial Intelligence:

Artificial intelligence possesses numerous features and attributes, including the following (Diab, 2022, p. 77):

- Using artificial intelligence on devices and machines lets them use logic to plan and solve problems.
- It can recognize sounds and speech and has the capability to enhance and develop objects.
- AI-based devices can comprehend and analyze inputs effectively to generate outputs that meet user needs with high efficiency.

- It allows for continuous learning, where the process of learning happens on its own and doesn't need to be watched or supervised.
- AI can process vast amounts of information it encounters.
- It is capable of identifying similar patterns within data and analyzing them more effectively than the human brain.
- AI employs intelligence to solve problems even when complete information is unavailable and can leverage past experiences to address new situations.
- It possesses the ability to think and perceive, utilizing trial and error to explore various scenarios.
- Artificial intelligence is distinguished by its capacity to respond rapidly to new situations and conditions, effectively managing complex and challenging cases.

5. Definition of Financial Financing:

Banking services include financing, which are the financial transactions and services that banks offer to businesses. Retail banking is when a bank works with people, while investment banking is when a bank works with capital markets. Businesses can get loans, credit cards, savings accounts, and checking accounts from banks.

Banking services are basically banks giving people secured loans. Financing can also mean that people are willing to take out loans or put money into investments. It includes any activity that involves accepting money from people and other businesses with the goal of lending that money out to make money.

From the aforementioned definitions, it is evident that financing is part of banking services; thus, it can be defined as a financial system focused on the efficient and effective management and allocation of funds by assessing ideas and their feasibility in targeted markets. Financing is also classified as a branch of applied economics, encompassing finance, loans, investments, financial planning, budgeting, and other topics related to fund management.

Many interpret financing narrowly as the ability to acquire necessary funds by some means; however, this understanding is inaccurate. Financing is broader and more comprehensive than merely acquiring funds. It involves the management, monitoring, and strategic planning of financial resources to achieve set objectives using appropriate economic tools, rather than solely supplying the necessary funding for projects. Its role extends beyond this narrow function ([Diab, 2022, p. 79](#)).

6. Evolution of Artificial Intelligence Usage in the Financial Sector:

Artificial intelligence began to gain prominence in the financial world during the 1980s, marked notably by the commercialization of expert systems technologies designed to solve problems and answer questions within specific contexts. In the 1990s, attention shifted towards fraud detection systems, leading to the introduction of the AI-based FinCEN (FAIS) system in 1993, which was capable of analyzing over 200,000 transactions weekly. Over a two-year period, this system contributed to identifying 400 potential money laundering cases with a cumulative value reaching up to one billion dollars. Although expert systems did

not maintain a dominant presence in finance, they played a critical role in paving the way for the broader adoption of AI as we know it today.

Since then, financial institutions began implementing artificial neural networks to flag suspicious financial activities for further human investigation. The first time AI was used in banking was in 1987, when Security Pacific National Bank in the US made a system to stop people from using debit cards without permission. Currently, banks employ AI technologies for activity organization, record keeping, stock trading, and asset management. In a simulated financial trading competition in August 2001, robots powered by AI did better than people. AI has also cut down on fraud and financial crimes by keeping an eye on how users act and spotting strange or out-of-the-ordinary behavior.

Recent advancements in AI have attracted considerable interest from specialists and stock market researchers. Artificial neural networks, in particular, stand out as some of the most promising models employed for stock movement prediction and analysis. Theoretically, these networks are capable of selectively approximating any nonlinear function given a sufficient number of hidden units. Financial institutions also leverage AI to enhance financial decision-making and reduce the time analysts spend on complex audits and asset evaluations. For example, auditors at Deloitte use AI resources to interpret thousands of contracts or behaviors. AI employs various methodologies to analyze current information and generate future forecasts. It is utilized to detect identity theft and fraudulent insurance claims, while providing managers with the necessary data to make informed decisions. Nonetheless, decision-making remains a human responsibility for now, although it is anticipated that a future will come where managerial decisions will be fully automated by software. As these technologies continue to advance, they will increasingly accomplish more complex tasks (Kunwar, 2019, p. 23).

7. Applications of Artificial Intelligence in Supporting Financial Decision-Making:

Artificial intelligence has existed for several decades, but it has only recently begun to significantly impact our daily lives. Today, AI is employed in a wide range of applications, from language translation and facial recognition to virtual assistants like Apple's Siri, often operating seamlessly in the background without drawing much attention.

In the financial sector, AI is utilized across various activities including chatbots and instant message responses to address customer service issues, fraud detection through anomaly analysis, underwriting, automated advisory services, forecasting, regulatory compliance, and aiding financial decision-making. The following section highlights key AI applications that significantly influence financial decision processes:

7.1 Risk Management:

AI can be used to make risk models and find possible threats in investment strategies, credit portfolios, or financial markets. Machine learning methods look at huge amounts of data to find patterns and connections, which lets them make predictions about risks. Investment firms use unsupervised algorithms to find

new patterns and networks in the market, and these algorithms often find connections that analysts didn't know about before. This information leads to more careful analysis, which helps lower the costs of market or portfolio volatility (Aparna, 2024, p. 58).

AI technologies proactively examine and prevent various instances of fraud, illegal tax evasion, and negligence by identifying potential risks. Organizations use individual data and behavioral patterns to detect irregular transactions. For example, Mastercard integrates AI within its cash services network to identify fraudulent activities committed by individuals. Similar technologies have also been applied to detect misconduct in commercial operations.

Artificial intelligence (AI) systems also facilitate real-time process evaluation across various industries and specific environments. Accuracy assessments and comprehensive predictions focus on diverse factors that are essential for corporate planning. The algorithms analyze risk backgrounds and identify early indicators of potential future issues. For instance, Crest Financial, a U.S.-based leasing company, implemented AI on the Amazon Web Services platform and immediately observed significant improvements in risk analysis without the delays associated with traditional data science methods. This enables decision-making to be grounded in comprehensive insights regarding market developments and associated risks, leading to more informed decisions (Kunwar, 2019, p. 26).

7.2 Fraud Detection:

Given that financial data is the most critical asset an organization must protect for its clients, AI is capable of detecting suspicious transactions and fraudulent activities promptly by analyzing historical data and processes (Aparna, 2024, p. 58). Feedzai, for instance, uses machine learning to evaluate operations in real time, keeping both an operational model and a challenge model that changes all the time to deal with new threats. ThetaRay is another company that helps banks and other financial institutions find risks like loan fraud, ATM breaches, money laundering, and cyberattacks. So, AI makes decision-making safer by giving us useful information about processes that could hurt financing decisions.

7.3 Lending and Credit Decisions:

Increasing regulatory requirements, growing complexity, and varying risk factor weights have made lending decisions more challenging in recent years. AI addresses this by delivering faster, more accurate assessments of potential borrowers at lower costs, incorporating a broader range of variables to support better-informed, data-driven decisions. AI-based credit scoring systems employ more sophisticated and advanced rules compared to traditional loan recording systems, enabling lenders to differentiate between high-risk clients likely to default and creditworthy individuals who lack a formal credit history.

Objectivity is another advantage of AI systems over human judgment, as machines are less likely to exhibit bias. Digital banks and loan issuance applications utilize machine learning algorithms to analyze creditworthiness using optional data sources, such as smartphone information, payment histories, and other relevant data, thereby verifying loan eligibility and offering personalized options.

7.4 Algorithmic Trading:

"Automated Trading Systems," or algorithmic trading, is a big part of the world's financial markets. It uses advanced AI systems to make trading decisions much faster than people can. These systems can handle millions of trades on their own in just one day. This kind of trading is called high-frequency trading, and it is one of the parts of the financial markets that is growing the fastest. A lot of banks, equity trading firms, and asset management companies only use AI systems to manage their portfolios right now.

Algorithmic trading employs software programs designed for high-speed, high-volume trading based on a predefined set of criteria such as stock rates and specific market conditions. One key advantage of algorithmic trading is the automation of order execution under optimal buying or selling conditions, ensuring that investors do not miss critical opportunities. This contrasts sharply with manual orders, which cannot match the speed of algorithmic trading. Additionally, since all processes are executed automatically by machines, human error is virtually eliminated. Algorithmic trading also tends to reduce transaction costs, enabling investors to make decisions that maximize returns while minimizing risks associated with emotional biases, which commonly affect most investors ([Kunwar, 2019, p. 26](#)).

7.5 Data Analysis:

Artificial intelligence is capable of analyzing vast amounts of financial data even when the input data is unstructured or less organized. Correlation structures and analyses are generated automatically with minimal human intervention. Machine learning can uncover new drivers or patterns that traditional analytical methods may fail to recognize, including historical price data, balance sheets, annual reports, and news sources. By leveraging algorithms and machine learning, AI can identify patterns, trends, and correlations that may be pertinent to investment decision-making ([Aparna, 2024, p. 59](#)).

7.6 Enhancing Financial Forecasting:

Artificial intelligence has revolutionized the financial industry by enabling companies to make more informed and precise decisions. One prominent application of AI in financial decision-making is predictive analytics, which allows organizations to forecast future market trends with greater accuracy. AI algorithms are capable of processing vast amounts of data from diverse sources, including customer behavior patterns, social media activity, and economic indicators. This capability enables the technology to identify potential risks or opportunities that might otherwise go unnoticed ([Modupe, 2023, p. 05](#)).

In the financial sector, predictive models are some of the most advanced AI-powered tools. What sets these models apart from more traditional ones is that they use a wide range of both traditional and non-traditional data sets. For example, some studies use a wide range of data, such as smartphone data, social and demographic information, to predict when people will default on their loans. AI-based predictive models give us more and better information in a shorter amount of time, which saves a lot of time and money when making predictions.

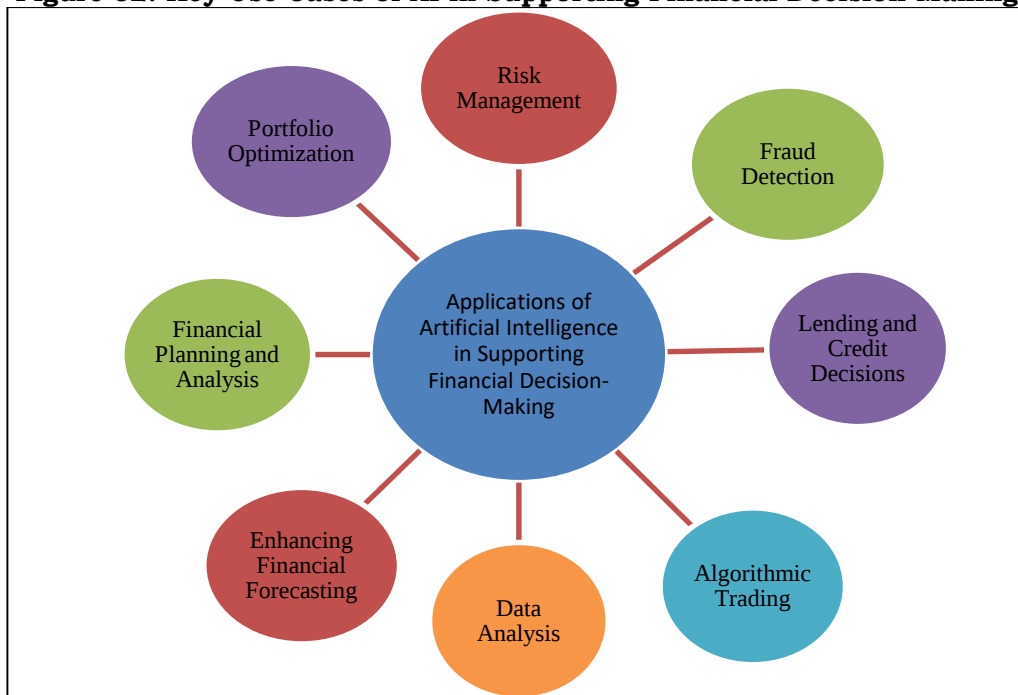
Different AI models also predict when a business will go bankrupt, when small and medium-sized businesses (SMEs) are likely to default, and when stock prices will change (Carsten & Lukasz, 2023). Examples include:

- In 2019, Sigrist and Hirnschall made a model to guess which small and medium-sized businesses (SMEs) in Switzerland would go bankrupt, followed by another model focused on credit risk prediction (Sigrist & Hirnschall, 2019).
- In 2020, Li and Mei employed a deep learning neural network with two hidden layers to forecast asset returns (Li & Mei, 2020).
- Also in 2020, Ruan and colleagues applied machine learning models to predict stock market returns based on investor sentiment (Ruan, Wang, & Zhou, 2020).
- In 2021, Petrelli and Cesarini integrated various AI techniques to predict high-frequency asset prices (Petrelli & Cesarini, 2021).

7.7 Portfolio Optimization:

Artificial intelligence can assist in optimizing investment portfolios by taking into account things like returns, risks, diversification, and liquidity. By looking at past data and using optimization algorithms, AI enables the identification of the most efficient investment combinations. This capability simplifies decision-making for financial managers. Unlike current automated portfolio improvement approaches, AI applications cannot merely rely on pre-defined "if-then" programming rules to enhance investment portfolios (Daube, 2024, p. 07).

Figure 02: Key Use Cases of AI in Supporting Financial Decision-Making



Source: Prepared by the researcher based on references in Section 7.

8. Benefits of AI-Driven Decision-Making in Finance:

Researchers and practitioners have found many advantages to using AI in finance, but they warn that these advantages depend on the size of the company. Larger financial institutions tend to gain more from AI adoption than smaller ones (Ashta & Herrmann, 2021). This disparity reflects differences in institutional capabilities, resources, and service scopes. The most notable benefits include:

8.1 Market Dynamics Adaptation:

AI-powered wealth management solutions enable financial leaders to swiftly adapt to market changes by providing real-time insights and predictive capabilities. Executives leveraging AI-driven analytics can anticipate market trends, mitigate risks, capitalize on emerging opportunities, and maintain ongoing success within a constantly evolving financial landscape.

8.2 Enabling Growth Initiatives:

Artificial intelligence technologies give financial leaders the tools they need to speed up business growth by using data-driven investment strategies to improve operations and drive huge growth in the sector. In the digital age, AI tools for managing wealth are no longer optional; they are a must-have because their analytics give you deep insights into what buyers want, how they act, what trends are happening, and what interests them.

8.3 Enhancing Informed Decision-Making:

AI-based decision-making gives financial managers the tools they need to make smart decisions, boost profits, and streamline operations through cutting-edge predictive analytics and machine learning technologies. AI-driven leadership makes decisions more accurate, which leads to the best results even in difficult situations.

8.4 Improving Operational Efficiency:

Machine learning algorithms work with a lot of data, which helps managers make better decisions more quickly. Managers can make processes easier and get better results by giving machines instructions or programs that help them use probabilities and suggest the best decisions.

8.5 Securing a Competitive Advantage:

Artificial intelligence's rapid development benefits businesses in every industry and gives market leaders a competitive advantage. Businesses may improve operations and boost profitability by using AI technologies to guide decision-making in asset management. This approach increases accuracy and decreases mistakes. Machine learning-based financial data analysis is predicted to see significant increases in accuracy and productivity as AI technology develops further. (Aparna, 2024, p. 60).

9. Risks and Challenges of Using Artificial Intelligence in Financial Decision-Making:

Artificial intelligence offers significant benefits to the financial industry in general and to financial decision-making in particular. However, researchers and practitioners have highlighted that the adoption of AI carries numerous potential threats and risks. Therefore, organizations, users, and regulatory bodies must

remain aware and vigilant regarding the possible drawbacks associated with AI to ensure its fair and effective use. Among the risks linked to AI-based financial decision-making are the following:

9.1 Explainability and Transparency of AI-Based Models:

Because AI models don't make decisions in a clear way, people often compare them to a "black box." This means that users can't fully understand how the system works, how decisions are made, or why those decisions are made. This makes it very hard to find mistakes and biases in the system, which could lead to results that are wrong or unfair. Also, the lack of transparency makes it harder to make AI systems better over time. Without knowing how they work, it's hard to find areas that need to be improved, which limits AI's full potential.

So, one of the biggest problems is making AI solutions more open so that they can reach their full potential, which includes better efficiency, accuracy, and cost savings. To fix this lack of transparency, researchers have called for making AI models easier to understand. Researchers in the field of academia are working hard to create AI models that are easy to understand, but adding explainability can make these models less efficient and more expensive to use. Researchers and industry experts still don't agree on what makes a good explanation of interpretable AI. Different stakeholders want different things from explanations, which makes it even harder to develop and compare methods for making things understandable.

These problems could hurt the financial sector in a number of ways. First, it's hard to find and fix mistakes or biases in the system if AI decision-making isn't clear. This could cause people to make bad or unfair choices that have bad results. Second, people might not trust an AI system as much if they don't know how it makes choices. This could make it less useful and less well-known. Third, if a lot of banks and other financial companies use the same AI tools and algorithms, the system might not be as safe. It's harder to model and keep an eye on these risks when there isn't enough information. This makes it more likely that the market will become unstable or even break down.

9.2 Fairness of AI-Based Models:

AI systems can copy and even make worse the biases that are already in the data they were trained on. If you don't carefully look at the training datasets, you might end up with outliers and false patterns, which can cause AI models to make wrong and biased decisions. These kinds of results keep biases and discrimination in society going. Also, using historical data that is widely available to train AI and machine learning models limits their ability to accurately predict future conditions, especially when important extreme events are missing from the financial data. This restriction makes it more likely that AI models will fail during crises.

9.3 Lack of Accountability for AI Outcomes:

One of the biggest problems with banks using AI systems is that they can't be held accountable for what they do. This issue is even more serious when AI is used to make important choices, like giving out wrong low credit scores that could lead to unfair loan denials. When important AI-based decisions are based on bad

training or biased, unrepresentative data, it's hard to know who to blame for the results.

Machine learning and other AI methods use past training data to figure out how to respond in different situations. They keep their databases and learning materials up to date as new information comes in. There are two big problems with getting people to know more about these technologies. First, decisions are made automatically, which makes it hard to spot mistakes. Second, auditors may not always understand why decisions were made. AI systems also make decisions quickly, which raises worries about security, social, economic, and political risks, as well as who is responsible for making those decisions. These things make people less likely to trust AI-based systems, which shows how important it is for AI to be simple and clear.

9.4. Erosion of Employee Skills in the Financial Sector:

More and more businesses and people are using AI in their work because AI technologies are getting better and there is more data available. But relying too much on AI can be dangerous in a number of ways, such as making people less skilled and less likely to learn the skills they need to make their own decisions.

Some researchers have noted that skills related to financial forecasting, planning, and decision support may soon experience reduced demand as financial institutions increasingly integrate AI systems. Concurrently, there is a growing challenge within the financial sector to upskill employees, training them to work more efficiently and safely alongside AI technologies.

9.5. High Cost of Errors:

Implementing AI can be prohibitively expensive for financial institutions, especially given the additional risks of substantial financial losses resulting from errors. This is particularly relevant in commercial banking, where loan amounts can reach millions of dollars. Traditionally, such loans were evaluated by human experts; however, with the rise of AI, these systems are assuming a more prominent role alongside human oversight. Should these systems make mistakes for example, approving a loan to an uncreditworthy party the bank will bear the consequences (Carsten & Lukasz, 2023, pp. 20-21).

9.6. Operational Vulnerabilities:

The stability of the financial system may be threatened by operational hazards brought about by the use of AI and machine learning, such as system malfunctions and data breaches, particularly during stressful times. In order to overcome these obstacles, stakeholders must work together to create strong governance frameworks, improve transparency, and guarantee the moral use of AI and machine learning in the financial industry.

9.7 Amplification of Risks and Emergence of Unintended Consequences:

The use of machine learning and artificial intelligence technology may intensify current hazards and predictive analytics in the financial industry. Their independence allows them to engage dynamically with market circumstances, posing unexpected new hazards. Furthermore, it might be challenging to predict every event and result that could occur in financial markets due to the

unexpected effects that AI-driven models may have on market integrity and stability.

9.8 Data Integrity and Concentration Concerns:

Poor-quality or biased data poses significant risks, leading to discriminatory outcomes and the perpetuation of disparities. This creates a critical challenge for artificial intelligence centered on ensuring data integrity and accuracy, which is essential to protect financial consumers from harm. Additionally, substantial investments in AI technologies may result in reliance on a limited number of large institutions and investors, raising concentration risks that undermine market diversity and innovation, and potentially create competition issues ([Aparna, 2024, p. 61](#)).

CONCLUSION:

The exploration of artificial intelligence within the financial sector underscores its crucial role in financial decision-making, demonstrated by the growing integration of AI-driven tools across the industry. These tools aid in developing risk models and identifying potential risks within financial markets, credit portfolios, or investment strategies. Applications of algorithmic trading based on machine learning, such as deep learning and decision models, contribute to generating insights and enhancing the accuracy of forecasts that directly guide decisions, including the timely automated execution of trades. Moreover, AI also makes it easier to build investment portfolios that are well-diversified and to use predictive analytics, which helps people make better and more accurate decisions.

These contributions have given banks and other financial institutions the tools they need to adapt to changing market conditions and speed up business growth through better predictive capabilities and investment strategies that are based on data and are timely. Also, AI has helped financial managers make better, faster decisions, make fewer mistakes, and give their institutions a bigger edge in unstable markets.

Even though people are generally happy with how accurate AI-assisted financial decisions are, there are still a lot of problems because of the risks and limitations that come with them. First, there is the "black box" problem, which is that it is not clear how AI systems make decisions. Second, biased data can cause you to make wrong decisions. Third, even though there are algorithmic methods to reduce it, too much noise in data can still cause big problems. Fourth, machine learning may not work well when there isn't a lot of data available. Fifth, there is still no one who is responsible for the results of AI. Sixth, making mistakes with AI-driven financial decisions can be very expensive.

Therefore, AI development needs to deal with unexpected effects on data integrity and look for ways to make models easier to understand. It also needs to change how it monitors and supervises things to deal with the problems that come with AI technologies and the higher systemic risks that come with more market interconnectedness because of these technological advances.

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