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Harnessing Artificial Intelligence: Revolutionizing Investment Decision Processes

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ABSTRACT

This document is about the evolution of investment strategies by AI in financial decision-making. Artificial Intelligence (AI) is creating a change in operational activity, decision-making process for investment, and assessing clients, by banks. The purpose of the paper is to highlight the opportunities available by AI in investment decision-making along with challenges, which should be addressed during implementation. A systematic literature review is been used to analyze the paper and make findings. Personalized investment advice, tailored to individual risk tolerance and goals, enhances decision-making. Overcoming barriers to AI adoption promises growth, innovation, and user-friendly investment experiences.

1. Introduction

An investment is the acquisition of an asset with the expectation that its value will increase over a while and provide income. As the inflation rate increases over the period the requirement for money would increase, to meet the inflation gap people invest their money outpacing inflation. This is because as inflation rises the purchasing power of money decreases over some time, thus investing in an asset that grows outpacing inflation will let people have purchasing power in the future. People also invest their money for specific goals like a child's education, retirement scheme, etc., Few invest their money to generate regular income or to have a secondary income source by receiving dividends, rental income, etc., and to avail tax benefits. The investments are made through investing in stocks, bonds, real estate, mutual funds, gold, silver, ETFs (Exchange Traded Funds), commodities, money market instruments, pension plans, term deposits, and more. Each investor would choose their investment instrument based on the willingness of the risk, the return expected, and their investment goals.

During the ancient days people invested in land, gold, and silver as a mode of investment, slowly after industrialization there was the introduction of banks and stocks, bonds, and other money market instruments. In the year 1602 Amsterdam Stock Exchange was established by the Dutch East India Company, this is the world's first and oldest stock exchange. Following this USA and other countries commenced their stock exchange including India. The Bombay Stock Exchange was established in the year 1875 and it is one of the oldest stock

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exchanges in Asia. Now, the investment industry continues to evolve with the introduction of new technology like blockchain into the market through which Bitcoin and cryptocurrency were introduced. The financial services industry is contributing $31138.82 billion in 2023 to the global GDP. The financial industry contributes around 20%-25% to the world economy (Sean Ross 2024, April). It is expected to grow at the compounded annual growth rate of 7.7% (2024, April 15).

Moreover, technology is also evolving rapidly after the introduction of AI (Artificial Intelligence) this has influenced the decisions made by individuals and organizations, due to accuracy rate, fraudulent prevention, efficiency, cost reduction, and personalized services. AI is to make computers learn and solve problems as humans. AI makes these decisions based on their experience and the available data. AI is used across various industries, in the finance industry AI is used for forecasting the financial statement and market, detecting fraud and reduction, scoring the credit of customers, and lowering costs. AI and ML algorithms are used to process the data of records of the business, social media information, financial statements of the business, the current affairs of the organization, and global indicators into a piece of useful information to decide on buy-side activities of investment and to manage the assets. Automated Trading Systems are used by investors to make entry and exit decisions through the signals made by ATS. The emergence of Robo-advisors would give investors to get access to 24/7 personalized services, with easy accessibility and affordability.

In the financial sector, the market value of AI is estimated to be around $9.45 billion whereas it is expected to grow by 16.5% by 2030 (2024, April 13). Barclays uses AI to enhance the security of operations through voice recognizer, this has increased productivity by 3%- 5% and the expenditure has been reduced by $300 billion (2024, April 12). JPMorgan Chase uses AI to create better customer experience which has led to the prediction of a 0.4% increase in output by 2034. BlackRock Aladdin is used to maximize the accuracy which completely evades the losses along with the ESG of the firm and increases productivity. These create the portfolio and make investment decisions based on the risk appetite of consumers. It is expected to increase the profits earned.

2. Review of Literature

2.1. AI in Decision-Making

The study by Wamba-Taguimdje (2020) [36] states the influence of AI in adding value to the business organization as solutions are made by using AI to process the data collected. As integration of AI is used to improve automation, information, and transformation. The study by Li *et al*. [20] states the implementation of AI from the initial process to high-level decision-making with data understanding by using machine learning algorithms, data mining, AI explicability, and NLP by considering 270 research papers to come up with strategies on remote sensing. The study by Pan *et al*. (2021) [27] states the use of AI in the study of hyperspectral images (HSIs). They use the data collected through hyperspectral sensors which are then transmitted to the cloud for analysis. This study uses a postprocess strategy of clustering the data and uses AI to reduce the cost and to make an appropriate decision. The study by Kushwaha *et al*. (2021) [19] was on businesses that used AI-based chatbots to provide unique consumer experiences, this is been analyzed through the diffusion of innovation theory, trust commitment theory, information system success model, and Hoffman and Novak's flow model from data collected through social media. The study used lasso and ridge regression to conclude that it has influenced customer loyalty and trust towards the brands and systems.

The study of Hoang and Pham (2016) [13] states the impact of AI in civil engineering activities and decision-making. Slope stability assessment is the major assessment influencing the decision of the engineers decision which was calculated manually earlier, but after the implementation of AI slope stability assessment is made using

machine learning and metaheuristics. The study analyses the real cases of 168 in various countries to propose a hybrid approach which has demonstrated a 4% increase in the accuracy of results. In the study by Ahmadi (2024) [2] impact of big data and AI in the financial industry, this blend of AI into business is used to improve the experience and efficiency by bringing in more advanced transaction processes and providing personalized responses to consumer demands. The study by Hajj and Hammoud (2023) [10] states the usage of AI in financial markets to make investment decisions on investing into market instruments. The study considered both AI and ML applications on algorithmic trading, risk management, fraud detection, credit scoring, and customer experience along with challenges and barriers. Which could provide insights to policymakers, regulators, and professionals about the challenges and benefits of AI adoption. The study by Gupta *et al*. (2023) [9] is on the influence of AI and blockchain technology on the financial resilience of the supply chain by collecting surveys from 227 supply chain professionals, from this the author concluded that blockchain technology is more effective in facilitating financial resilience than AI.

2.2. AI in Different Functions

AI is replacing the functions of all industries like healthcare, E-commerce, education, business, banks, etc. A study by Krishna *et al*. (2023) [18] states the influence of IoT, big data analytics, and AI impact on marketing. Marketing decisions are based upon the data collected through customers, and their purchase history, these data are processed through AI and big data for market research and make strategies for obtaining future goals. The study by Murugesan *et al*. (2023) [24] opportunities for using AI and IoT in the workplace for maintaining human resource functions. This adoption of Industry 4.0 would provide more efficiency, flexibility, and precision to HR. The study included 271 HR experts from various sectors like IT, manufacturing, and administration for the interview. SPSS and AMOS were used to analyze the data collected and concluded by stating that well-being and safety improvements were vital considerations under the implementation of AI in HR. The study by Limna (2023) [21] is on AI adoption in the hospitality industry. This would improve personalized customer service, increase operational capability, and reduce the cost of operational activities for the firm. Managers and businesses would provide better business performance in terms of return on investment and meeting the expectations of consumers and employees. The study by Korzynski *et al*. (2023) [17] influences AI at strategic, functional, and administrative levels of business. The study processes management theories and organizational changes.

3. Systematic Literature Review

The keywords “Artificial intelligence” AND “Investment”, “Artificial intelligence” AND “Investment Decisions”, “Artificial intelligence” AND “Portfolio Management”, were given in the Scopus database and Proquest database, and from a list of articles generated there was filtration done based on the year 2000 to 2024. Once the list was reduced further reduction was done based on the subject area and type of document. Once the list was compiled based on the above filters the availability of the papers was looked into and papers that were not accessible by the researcher were left out and papers were considered for the study which were accessible. Once this list was compiled the abstracts were looked into for relevance and connection to the research topic articles that were not connected to the research topic were omitted and finally, a list of 584 documents were considered for the study.

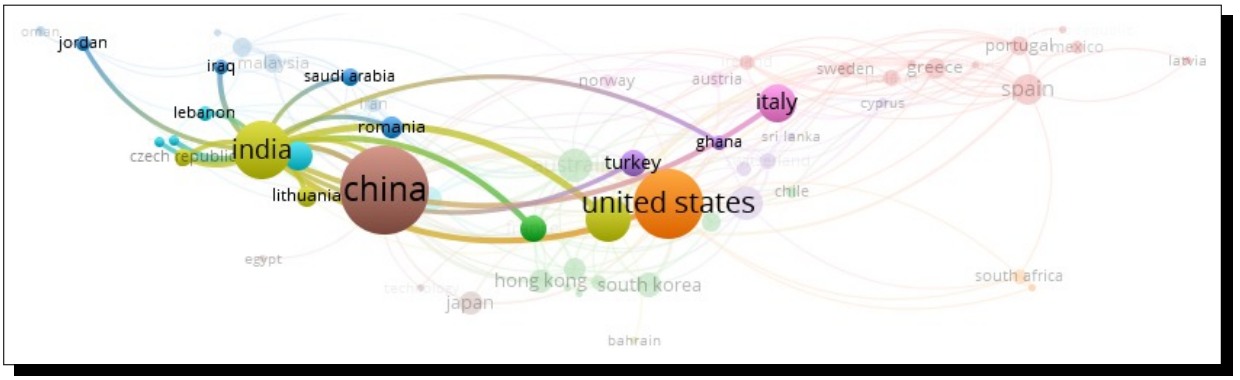

Figure 1: Network of authors from India (Source: vosviewer)

Figure 1 illustrates the interconnectedness of Indian Authors with global countries and it can be inferred that a majority of the collaborations happened with China, the USA, and Italy.

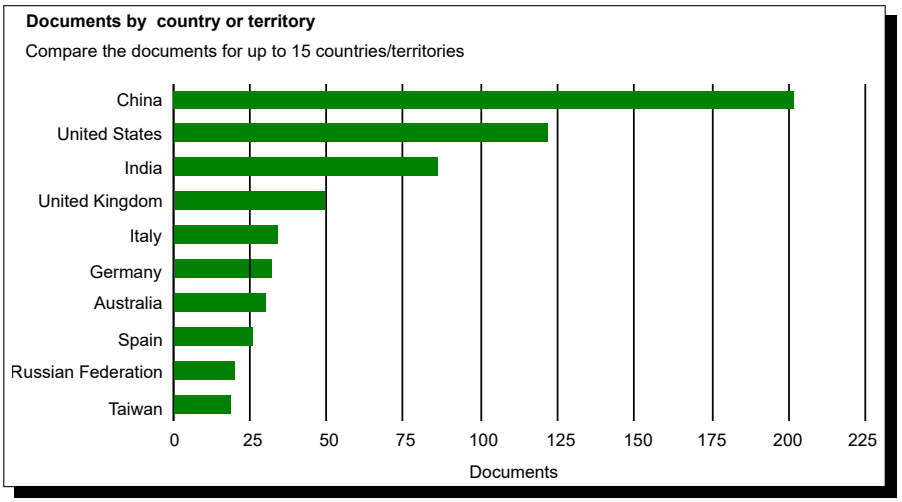

Figure 2: Documents by country (Source: vosviewer)

Figure 2 represents documents referred to by various countries on the impact of AI on investment decisions. The chart lists countries heavily investing in AI, in that China is a leading country in doing more research on AI which would lead to more sophisticated investment followed by the USA and India.

Figure 3 represents the different subject areas in which the documents are been distributed. Among the references 22.1% of the paper is on computer science followed by Business and management and the prominence of this shows the influence of AI in shaping the future.

Figure 4 above indicates the type of document for the data set. The dominance is shown through conference papers by 50.2% and articles by 38.1%.

Figure 5 presents the keyword analysis of the articles identified for the study and indicates the major keywords often used by authors as AI, Decision support system Stock Market, Efficiency, Finance, Fintech, Industry 4.0, Decision Making, Risk Management, Modelling, Forecasting and more.

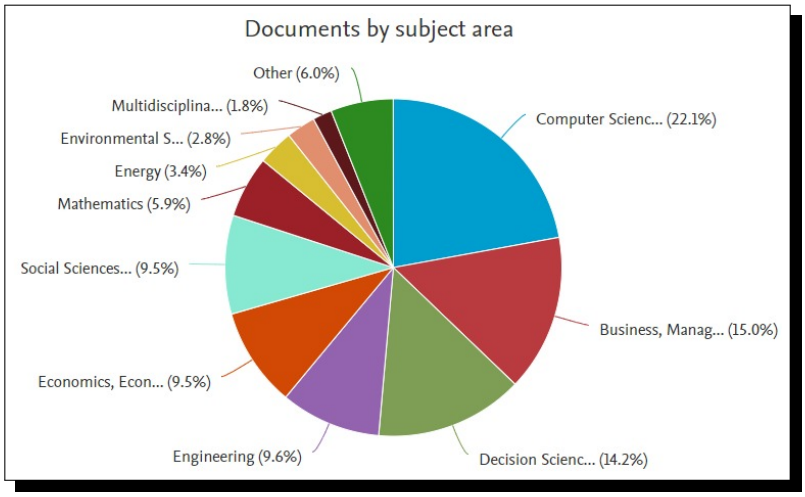

Figure 3: Documents by Subject area (Source: vosviewer)

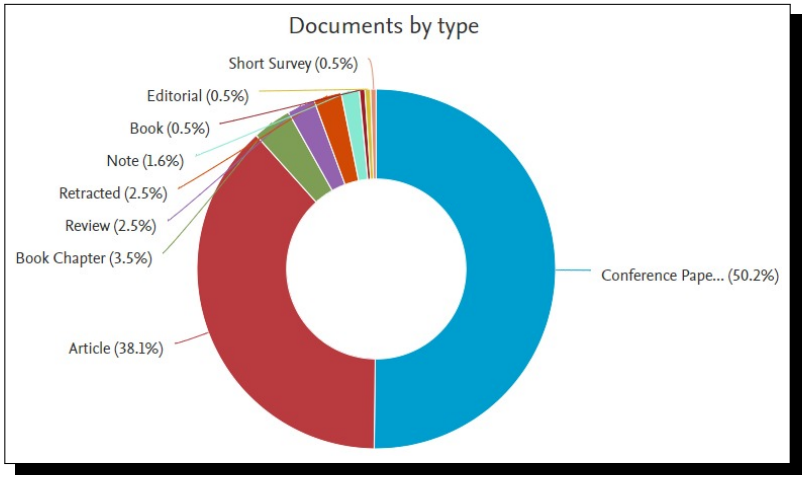

Figure 4: Documents by type (Source: vosviewer)

4. Decision Process

Nowadays, investors make decisions using a financial decision support system. These support systems do not make decisions based on predetermined equations and time series models to make investment decisions rather the predictions of the stock price and investment decision are based on results obtained by machine learning modeling and other specific neural networks. This system architecture includes four main components they are computational systems that can run software like Octave and Matlabs for machine learning models. Historic data is the key factor which is been used in making the decision, past years' data are analyzed to make the decision which is collected through Yahoo Finance, Money control, Bloomberg terminal, etc., In addition to historical information, the current information on the price of stocks and other factors influencing the price of stocks are considered to make appropriate decisions with the user interface. The decision process in making an investment decision is based on the risk and return. The advisors analyze the risk appetite level of customers and their expected return and make the investment plan into their preferences. The higher the risk higher the return and vice versa.

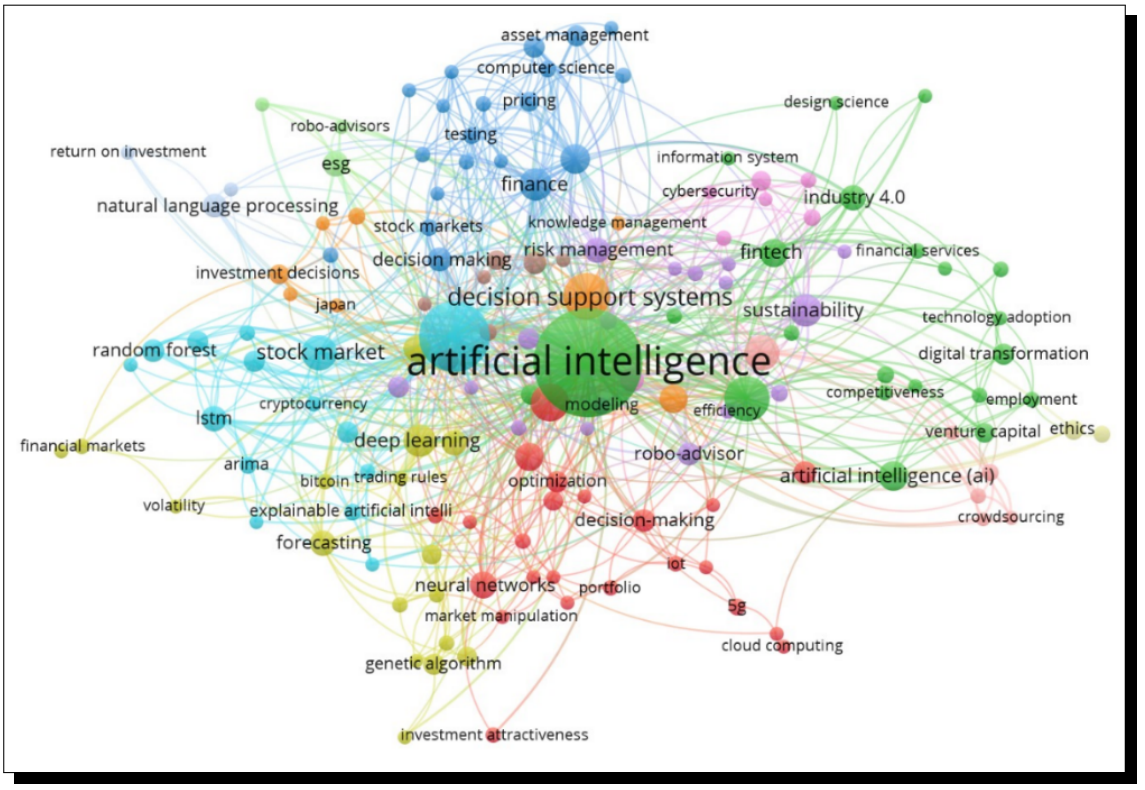

Figure 5: Keywords analysis (Source: vosviewer)

4.1. Application of AI in Investment Decision

In today's operation of business activities, AI is used to replace the repetitive tasks handled by the human workforce to focus on strategic work. This is been applied to various day-to-day operations of activities with the resource to achieve efficiency and to increase the profits. Here is a list of a few applications of AI in making investment decisions as shown in Figure 6.

AI is applied in the finance industry to make *predictive analysis* using historical data to identify patterns and then predict future outcomes. which is majorly used in banks to identify the creditworthiness of their customers to provide the loan based on their credit score, and ability to repay the principal, which provides necessary information to bankers on bank approvals and interest rates to be fixed. TruMid is a fintech company that uses "Fair Value Model Price (FVMP)" predictive analytics engines to analyze bond details, credit ratings, market sentiment, trading volume, and economic indicators (Veerla, 2021 [35]).

Algorithmic trading is evolving the trading pattern with decisions made using high speed and precision. The computer program uses these algorithms to do the buying and selling of financial vehicles in the market, with pre-defined instructions on their volume, price, and time. One of the basic algorithmic trading used is the moving average crossover strategy, which calculates the 20-day average price of a stock with its current market price, if the current price indicates a downtrend the algorithm sells the stocks whereas if it indicates an uptrend it might buy stocks. These use both historical data and technical indicators to make the investment decision. Renaissance Technologies is a pioneering hedge fund company that uses AI in algorithmic trading. Which has provided them with unexpected returns (Cohen, 2022 [4]).

AI is used in managing the risk or uncertainties of investing preventing, avoiding, and mitigating the risks.

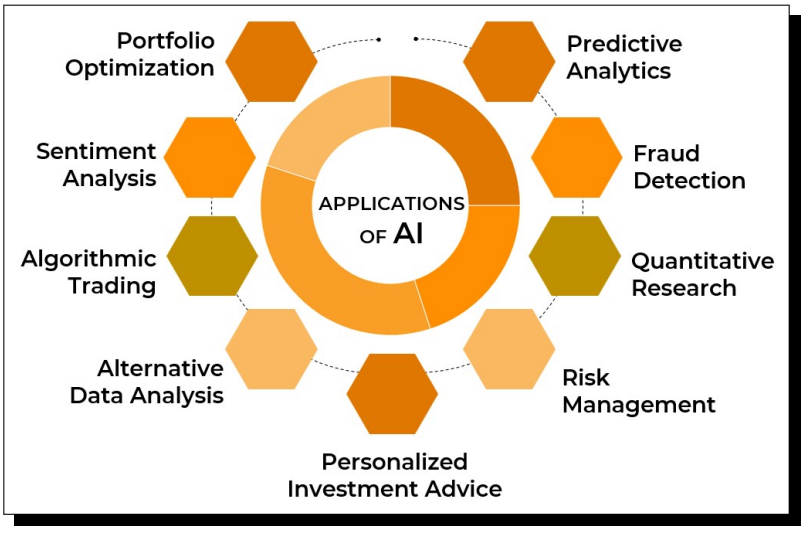

Figure 6: Applications of AI in investment decision (Source: Author's own)

Investment decisions are based on using historical data, and market trends, by considering economic forecasts and the risk appetite level. This is been used in banks in the majority of scenarios to decide whether to issue a loan and the rate of interest to be charged. JPMorgan Chase uses AI in *risk management* to identify fraud, credit risk assessment, and market risk assessment (Ren, 2021 [32]).

Sentiment analysis finds out the opinions and responses of the stakeholders of the business. AI is used by running computer programs through the articles published about the business, their social media posts, and the annual reports to find the tone. It is been categorized into three types: positive, negative, and neutral. This is used by long-term investors to analyze the overall buzz and is used for making investments in the purchase of a company's stocks. Morningstar Inc. provides reports for individuals on investments based on the growth potential of the financial vehicle through Natural Language Processing (NLP).

Alternative data analysis is the method of assessing indirect data about an investment vehicle or business through their social media sentiment analysis, job postings, transaction data, foot traffic, etc., alternative data analysis is used while making decisions on mergers and acquisition of business where these analyses would provide a detailed review on the probability of long term relationship between business, and investment decisions. Kensho Technologies anticipated early market trends by identifying hidden risks and opportunities in the market with social media and news outlets (Ekster and Kolm, 2021 [7]).

Portfolio optimization is the mix of different financial vehicles to create an optimal portfolio on the risk appetite of the customer with maximum profits. AI uses a large number of data to verify the trend and pattern in each investment and provide a personalized optimum portfolio to the expected return and risk appetite of the business and they change easily to market conditions. Fidelity Investments uses Automated Managed Platforms (AMP) to provide personalized portfolio service for each client, Deutsche bank has partnered with Nvidia for this (Adebiyi *et al.*, 2022 [1]).

Fraud detection is the identification of illegal financial transactions and prevention, these are identified by massive data analysis, pattern recognition, and predictive modeling. AI analyzes historical data and identifies patterns representing sudden surges or declines in a particular region, which prevents losses that occur through fraudulent activities and increases financial security. Mastercard uses AI to detect fraud in credit card and debit

card transactions through machine learning algorithms and real-time transaction analysis, behavioral baselines, and geographic location verification (Lokanan and Sharma, 2022 [23]).

Personalized investment advice is recommended through AI to individual investors based on the individual's risk tolerance, investment goals, duration of investments, and the current financial situation of the investors. AI-based personalized investment advice provides quicker analysis, and continuous monitoring of investment vehicles provided with current changes in the market, and the AI algorithm reduces the bias due to emotions influencing human advisors. Betterment is a robo-advisor that provides personalized investment management to their clients based on their requirements (Capponi *et al.*, 2021 [3]).

Quantitative research are powerful calculator to indicate the pattern and relationship for vast datasets of stock prices, economic indicators, and company financial etc., these are combined to form a model through an algorithm by AI that predicts future markets including market crashes. Quantopian is a pioneer in using AI for quantitative research for a wide range of institutions and individuals (Saint-Pierre, 2017 [33]).

The application of AI is vast in the whole financial industry, it is revolutionizing the diverse fields in the industry. Continuous development in AI technology will maximize the benefit of its usage and gain a competitive advantage.

4.2. Barriers of Adopting AI

The introduction of AI is revolutionizing the world currently. However, there are significant challenges in the adoption of AI into business.

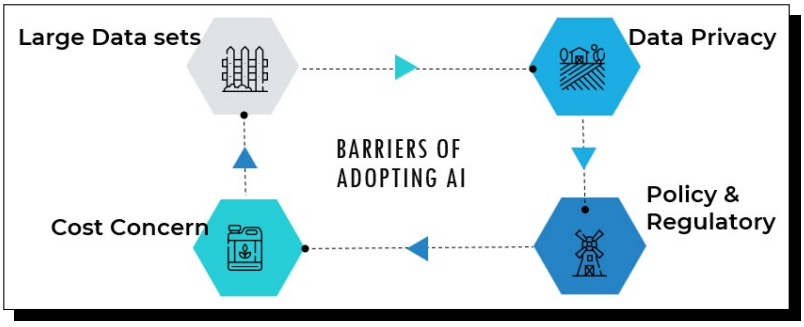

Figure 7: Barriers of Adopting AI (Source: Author's own)

Large Data Sets

There are a lot of hindrances to adopting AI in the financial sector. The availability of data is the greatest barrier in adopting AI either as structured data or unstructured data. Large datasets are required by AI to identify patterns for making decisions, which should meet the level of reliability, quantity, and various demographics of customers. With the use of IoT large data are processed and labelled. For example, High-Frequency Trading (HFT) uses AI to make trading decisions with market data. Which requires infrastructure requirements, data aggregation, and cleansing. The data provided to AI should explained in detail and with accuracy for making efficient interpreting and understanding. This has to be increased through LIME (Local Interpretable Model – Agnostic Explanations). Investment teams would not prefer the recommendation made out of data without explainability (Kushwaha and Kar, 2021 [19]).

Data Privacy

Data privacy policies by different countries would act as a barrier Europe follows the General Data Protection Regulation (GDPR) which enforces the right to collect, process, and use for privacy. Protection policy would

limit the application of AI which results in the prediction made through AI. Moreover, we face barriers in hiring employees with relevant knowledge, or training on specific AI in financial services has to be provided which takes a huge time and investment for the company (Dwivedi *et al.*, 2021 [6]).

Policy and Regulatory

Policy and regulatory norms for the usage of AI in financial services for various factors like economic indicators, social equity, and knowledge. These policies have to be made inclusive of all stakeholders of the business, on the ethical consideration of data collection biases, governance of data is important for successful implementation of AI. Getting adopted into an updated legal framework and compliance issues is a significant barrier to the adoption of AI (Dwivedi *et al.*, 2021 [6]).

Cost Concern

The major barrier is the cost involved in adopting AI into financial services as they require a cost on technology installment, data management, talent acquisition, R&D, development cost, infrastructure cost, training, and security. But return on investment would be gained in the long term. The cost of adoption would be more than $500,000 approximately to even millions of dollars, this would vary based upon the specific requirements of a business (Hellendoorn and Sawant, 2022 [12]).

Even though, AI is an efficient instrument it has a lot of hindrances preventing the usage of AI in their operations. By finding solutions to infrastructure, ethical policy, and cost, AI could be used in business and transform the functions of business to come up with new innovations.

4.3. Factors Influencing the Adoption of AI

Various factors are affecting businesses to integrate AI into their business, these influence the decision made by businesses either to integrate into their business or not.

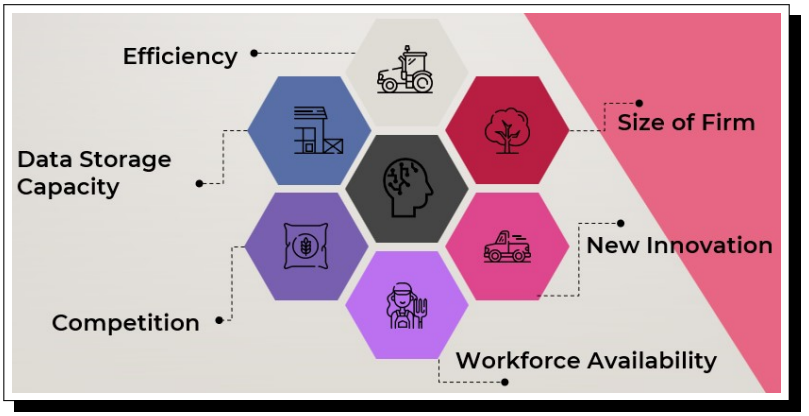

Figure 8: Influencers of adopting AI (Source: Author's own)

Usefulness

Adopting AI in investment companies is decided based on the usefulness of AI in their business. If the business decision-making process involves a large set of data to be analyzed, businesses would opt for integrating AI into their business AI which could likely increase efficiency, improve decisions, and provide personalized customer experience (Cubric, 2020 [5]).

Technology Infrastructure

The availability of technology in the business infrastructure is the major factor. The adoption of AI will require reliable systems, technology hardware, and software to adopt AI into the business (Cubric, 2020 [5]).

Competitors

The competition by new start-ups and existing competitors would influence the adoption of AI as the accuracy level of their competitors would attract their existing customers. AI provides data on arbitraging opportunities for the customer, personalized optimization of portfolio, and managing risk more effectively than human traders (Roberts *et al.*, 2024 [29]).

Size of the Firm

The size of the firm would affect decisions on the implementation of AI into business, larger firms are more likely to adopt AI. As these firms would have sufficient funds to adopt AI. Even small businesses are adopting AI to enhance sourcing and screening processes (Rõhm *et al.*, 2022 [30]).

Risk Tolerance Level

Firms with high-risk tolerance levels would opt to adopt AI into their business, as they want innovations in their services. AI can automate repetitive tasks, but businesses need to meet the ethical considerations, and address security concerns (Rõhm *et al.*, 2022 [30]).

Skilled Workforce

The availability of a skilled workforce in the organization would be a significant reason for integrating AI into their insights. Existing employees should either have a workforce with prior knowledge of AI or a proper training program has to be provided for handling AI to existing employees by the experts of the industry (Rõhm *et al.*, 2022 [30]).

Adoption of AI in making investment decisions requires consideration of these factors and the business should make a strategic approach. Understanding these factors will lead businesses to make an optimum decision for achieving the goals of the business.

5. Conclusion

Artificial intelligence is transforming the investment industry in making portfolio management, risk assessment, and choosing investment vehicles. AI empowers in the identification of hidden patterns and opportunities in new markets for investments. AI is used for navigating the current and future market complexities. Adopting AI in investment decision-making has its benefits and drawbacks. AI has increased accuracy and prevented fraudulent activities like insider trading. This would create a huge impact on the reduction of scams in the financial sector. But, in the future AI would reshape the complete landscape of investments. Overcoming the barriers and adoption of AI in Investment decision-making will lead to further growth in the investment industry, innovations in markets, user- friendly for individual investors to make investment decisions. Further studies could carried out on Ethical considerations of AI and Explainable AI in the investment industry.

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