



THE ROLE OF THE INTEGRATION BETWEEN ARTIFICIAL INTELLIGENCE AND BLOCKCHAIN IN FINANCIAL SECTOR

Abderrahmane BENNAICHE*

University Of Algiers3-Algeria

bennaiche.abderrahmane@univ-alger3.dz

Laboratory of Economic Transformation Strategies

Dalila KADA

University Of Algiers3-Algeria

Kaddidalila@gmail.com

Mansour AISSANI

University Of Algiers3-Algeria

mansouraissani2@gmail.com

Laboratory of Economic Transformation Strategies

Send Article Date: 15-04-2026

Date of acceptance of the article: 02-05-2026

Abstract:

The proposed research uses the descriptive and exploratory methodological framework to analyze the concept of integrating artificial intelligence and blockchain technologies in the financial industry. The results show that as much as this convergence leads to a higher level of transparency and less transaction costs, it also comes with enormous challenges. The major issues are security and legal risks related to decentralization and, increasing environmental and energy impacts.

Keywords: Artificial intelligence, Blockchain, Financial Sector.

Jel Classification Codes: C55, G23, G28

Introduction:

The new wave of technological changes has catalyzed radical changes that have in turn impacted in the majority of the fields such as the financial sector. As artificial intelligence appeared and was transformed into a rather important fact and means of analysis and decision making and the development of the blockchain technology as a complex guarantee system providing transparency in the transactions.

Still amid these changes, a new trend has been observed when it comes to the integration of artificial and blockchain technologies in one and the same area with the purpose of using their opportunities in

* Abderrahmane BENNAICHE.



terms of improving the financial sector either with the aggregates of the transparent nature of its transactions, their automatization, or successfully handling the run of risks at the same time reducing the amount of potentially paid expenditures. Nevertheless, notwithstanding the beneficial effect of this integration, this fact does not disclaim the presence of the problems that cannot be disregarded, and that is why this issue has become extremely important to consider how the financial sector will look like in the light of this rapid change.

1.1- Research Problem: Our primary research question is as follows;

How pervasive is the effect of combining Artificial Intelligence and Blockchain in the financial industry?

On this basis, the following questions arise:

- What does it take to integrate Artificial Intelligence and Blockchain?
- Which are the major cross cutting points in the financial sector where the Artificial Intelligence and Blockchain can be useful?
- What are the issues entailed within Artificial Intelligence combination with Blockchain?

1.2-ResearchSignificance

- The information and data of the records present on the Blockchain are used to train AI models that develop efficient systems that have more chances of detecting fraud.
- The involvement of Blockchain technology and AI models also helps create systems that will be able to predict manipulations or even predict a crisis before it began.
- The interjection of the two technologies further helps in enhancing and growing financial inclusion by coming up with cheaper, safer, and more reliable digital operations.

1.3- Research Gap: Even though the economic and the technical aspects of the financial sector have been studied several times separately, surprisingly there is a certain shortage of studies that combine both sides in a combination. The literature, which is currently available, is not very rich in discussing the compound effect of this

integration, especially about how this might help improve operational efficiency, as well as present new security and regulation issues. Furthermore, the few studies on which one can find information tend to be insufficient in providing a more in-depth analysis or useful implications. It is an exigence that requires interdisciplinary studies comprising both economic and technical factors to include better comprehension of the consequences and viability of integrating the two in the financial sector.

1.4- Research Methodology: To ascertain market trends as pertaining to the integration of Artificial Intelligence (AI) and Blockchain technologies in the financial sector, this research paper uses an analytical descriptive approach and an explorative strategy to analyze the set of financial market trends. The descriptive part is supposed to provide the detailed summary of the current trends and dynamic and the exploratory one is to define and examine the expected benefits, opportunities, and challenges a combination of these two new technologies may provide. The framework helps one gain an in-depth insight into the economic and technical ramifications of their assimilation, and by extension provides relevant information to researchers, practitioners, and policy-makers.

1.5- Research Objectives: The proposed research aims to realize the following objectives:

- Determine the strengths related to the combination of Artificial Intelligence (AI) and Blockchain technologies in financial sphere.
- Examine the risks and the challenges that are likely to arise as a result of the collaboration of these technologies.
- Formulate a vision on how to effectively and sustainable integrate the AI and Blockchain, outline potential fields of use and the extent to which they could be applied in future financial systems.

1.6- Research Structure: The research is divided into two main sections:

- Section one: Theoretical framework of artificial intelligence and blockchain



- Section two: Practical of the integration between artificial intelligence and blockchain in financial sector.

2- Artificial Intelligence

The twentieth century has seen an immense growth in the area of Computer Science starting with the invention of large-scale computers that were both costly and only available in the military organizations and the universities.

This was supplemented by this outstanding development of the programming languages, which facilitated communication with the machines. The idea of Artificial Intelligence started to develop in the 1950s-1970s with research in such spheres as Natural Language Processing, machine learning, knowledge representation.

At a later stage, the proliferation of computer networks ensued and initiated the creation of databases, which came as one of the primary components in handling digital information.

In the 2000s, we moved to the Generative Artificial Intelligence that have now been extensively used in enhancing productivity. This again resulted in revenues of the corporations and helped in the growth of economies globally.

2.1- The Definition of Artificial Intelligence:

One of the most popular debates that have recently developed and especially after the revolution in the artificial intelligence field is whether machines are intelligent or not. This is the very argument of what is intelligence. Others argue that the intelligence is based on the level of consciousness and awareness therefore shunning the intelligence of a machine. Other people regard it as an expertise type of intelligence, which occurs in the capability of being able to handle certain duties well with minimal error rate. This contrast represents how hard it is to define intelligence whether as in relation to awareness and capacity or as the aptitude of solving problems without wasting much time and with good results.

The definition of artificial intelligence has changed with the role played in the particular time. to others have termed it as the capacity to do things right with focus on decisions and their consequences. Artificial intelligence is therefore a technology that has the capacity to deal with problems and challenges in a similar way as humans think and analyze the issues that the results of the artificial intelligence seem to be almost comparable with what was done by the human beings (AWS, 2025).

It may also be seen as a science that deals with the invention of machines which have the behaviors that are believed to be intelligent by humans or as Russell Bell described it: “the endeavor to make every day machines act like the machines in the science fiction movies” (Russell, 1977, p. 109). It implies that artificial intelligence is a discipline that seeks to empower the machine in carrying out the activities that are the sole preserve of the human being, which would include education, creativity, identification of problems among others. Therefore, AI can be found everywhere as far as households that use smart household appliances and voice assistants, self-driving vehicles, and advanced financial tools. Artificial intelligence also demonstrates its capacity to employ technology to extract information on big data, automation of functions and boost quality of decision in service industry especially on critical aspects like risk, frauds, money laundering and taxation.

2. 2- Types of Artificial Intelligence

As a matter of fact, no definite line was drawn between the linguistic models that were based on the logic arguments and the models of desired behavioral movement since the dominant concept was aimed at trying to combine them into one. Even certain proposed building devices are a combination of neural networks and symbolic processors in order to have a compromise between neural networks and symbolic processing to simulate brain functions and logic. But after 1960 an intellectual division took place (the symbolic school centering on logic and connectionist school on neural networks), which predetermined the direction of evolution in which the artificial intelligence is currently moving (Margaret A. Borden, 2018).



Artificial intelligence has been classified into several capabilities as follows (Strelkova, O, 2017):

- Narrow Artificial Intelligence;
- General Artificial Intelligence;
- Artificial Intelligence with super intelligence.

2. 3- The Importance of Artificial Intelligence:

The gainfulness of artificial intelligence is manifested in areas where the same has been applied and some of them include:

- **Healthcare:** Smart models will be able to read X-ray pictures, and even guess what illness a person has depending on signs. Moreover, AI will be able to remind the patients about taking their medication at the right time and it can even give them tips about good and bad foods based on the health status (Al Kuwaiti, et al., 2023).
- **Consumption:** There are a lot of suggestions that have been given in purchases by the modern models and they can be also consulted in regards to buying items depending on the needs of the person and his purchasing capacity (Bai, L., 2021).
- **Manufacturing:** A great number of manufacturers have issues and challenges in relation to enhancing the quality and decreasing the costs and in many cases these two factors are not correlated. But at the present time, AI is trying to automate hard procedures and complex activities in response to such sorts of problems. It can detect the possible quality issues in the models, prevent rework, and time loss with the help of image analysis (image recognition technology), and achieve the results in the improvement of product quality using deep learning methods (Arinez, Chang, Gao, Xu, & Zhang, 2020).
- Artificial intelligence is the key to ensuring cyber-attacks do not happen by implementing smart systems that may identify unhealthy trends. It takes data, analyses and interprets it to give it a more in-depth strategic insight into both the opportunities and the challenges hence assist with effective recovery plans and lowering costs.

2.4- The Importance of Artificial Intelligence In Financial Sector

Significance of artificial intelligence in the financial sector entails (McGrath & Downie, 2025):

- **Customer Services:** AI facilitates answering any questions and inquiries at any moment, which also eliminates the necessity of involving a human, as well as decreases the number of failures and improves cybersecurity.
- **Data Analysis:** AI can be used to analyze large data sets within a very short period enabling it to flag errors that would take too much time and effort to identify them manually.
- **Risk Management:** AI has the potential to analyze the data which will help financial institutions manage and assess risks efficiently and effectively, thus raising the level of security and trust.
- **Market Trend Prediction:** AI can predict market trends using the available information hence affecting the decision-making.
- **Reduction of Cost:** It will reduce cost by automating financial work with artificial intelligence.

Three aspects can illustrate the influence of the AI in the financial market (Tobias, 2024):

- **Efficiency:** Artificial intelligence enhances productivity by not only introducing efficiency in already ongoing tasks and processes, but also, through automation. Also, the degree of dependence on the AI technologies paradigm is likely to rise and gain pace in the future.
- **Evolutionary enhancements:** More than 10 years ago, leading investment firms employed AI, in the shape of neural networks and machine learning, thus taking part in automated trade in a huge way. Large language models (LLM) create an opportunity to handle great sums of information (even though it might be arbitrary and meaningless) and associate it with the ideas linked to past events similar to those that happen at the moment. This makes it possible to make broader and more comprehensive predictions which are easy to meet complex documents like earnings reports or bond terms by investors. This will eventually result to prices



discovery in various asset classes. Moreover, AI enables investors to tap the emerging market and corporate debt, popularly characterized by their low liquidity, increased risks, and high returns opportunity.

3- Blockchain Technology

The distributed ledger technology which is also known as block chain is the largest digital ledger that makes the direct transfer of ownership between parties efficiently, without requiring any third party. The registrars in the system confirm the process and this technology can be defined as maintaining a high level of security and transparency so that all the people in the world can participate in it without fail (Crosby, Nachiappan, Pattanayak, Verma, & Kalyanaraman, 2015).

3.1- Definition of The Blockchain

Blockchain as a word is novel in the sense that it appeared by the end of 2008 and was put into operation in 2009. All the data is verified through the blockchain technology that prevents data copying and reuse on different locations (hence a Bitcoin cannot be sold in one direction and be used to purchase a product in another store). Developing the blockchain had the aim to make sure that no one can create a duplicate Bitcoin and keep a strict trace of it without having to hide anything (Hirsh & Alman, 2020).

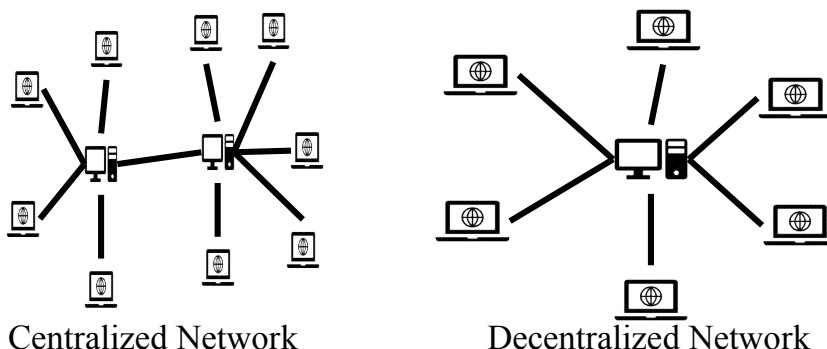
A blockchain can be described as a decentralized system, where every user can be connected to each other, i.e., there is no central point of control. Validity of transactions is ensured and maintained by other nodes that are linked to the system. The feature that remains the most crucial about blockchain is its decentralization that has attracted a great deal of attention towards itself.

Also, the blockchain can include such types:

- **Public Blockchain:** In this form, anybody can access and join the system, and it is renowned to be transparent. It is the easiest common among others and it is applied in the trading of cryptocurrencies such as Bitcoin and Ethereum (Guegan, 2017).

- **Private Blockchain:** This kind of blockchain is governed by a sole party which may be a company or government. This system is limited and one has to be authorized by the controlling company. The type is employed in manipulation of data in an enclosed safeness way (Dinh, Wang, Chen, Ooi, & Tan, 2017).
- **Consortium Blockchain:** In this type, the group of organizations collaborates to manage the system giving transparency and control to the organizations that are part of it (Xiaotong , Songlin , Linfu , Yangxin , & Chase Q, 2024).
- **Blockchain as a Service (BaaS):** These are the templates provided by the large cloud offerings like Amazon Web Services (AWS) and Microsoft-Azure. This one is chosen because it does not imply the establishment of a separate infrastructure (Zheng, et al., 2019).

Fig N° 1: Centralized and Decentralized Network



Source: (GeeksforGeeks, 2025)

<https://www.geeksforgeeks.org/system-design/comparison-centralized-decentralized-and-distributed-systems/>

3. 2- Components of Blockchain:

Blocks: Basic structure of block chain is based on the use of blocks and every block holds a group of operations and tasks run through the chain. Moreover, the security of the information is provided by means of encryption so that it cannot be touched. Every block has three principal parts (Crooks, 2023):



- **Information:** In every block, there is information connected with the transaction that has taken place in this block and there is entire information connected with the transaction, such as the date of creation, the version number and other facts existing part of the block.
- **Hash:** This is a sequential code that is generated on the basis of a complicated calculation. Even a minor alteration of the data in the block leads to an absolutely new hash (even a single character change), and this keeps hacking and fraud at bay.
- **Previous Hash:** The hash of previous block in the chain is found on every block. This connection is one of the guarantees against any special manipulation of any block since there is no opportunity to modify the information contained in a block so that nobody will notice.

3. 3- Importance of Artificial Intelligence in Blockchain Technology

The advantage of the artificial intelligence to the blockchain technology is that it helps to enhance and boost the efficiency, productivity and speed, also, providing data protection. In one word this can be summed up as:

- **Automation:** Incorporation of blockchain with automation can offer the benefits of less human involvement and more productivity besides ensuring security of data. At the blockchain level, AI models in smart contracts can be used to perform several tasks such as retrieval of expired products, reorder request, processing of payments, or handle inventory based on occurrence of a defined event. Even the manner of data interpretation and analysis can be simplified with the help of quantitative techniques that can be used at a great speed (Xing & Marwala, 2018).
- **Performance Enhancement:** Artificial intelligence offers an attractive ability in reading and analyzing data at a high rate, which places this application at a better position. Blockchain has the capacity of accessing large volumes of data securely and transparently leading to a better sharing of data which in turn benefits various parties and models (Xing & Marwala, 2018).

- Infrastructure: The infrastructure behind artificial intelligence is understood in a better perspective through the digital ledger offered by the blockchain technology and the sources of data it uses. This could beat the problem of human interpretable artificial intelligence, hence, the resultant increased data security in case AI models are distributed and stored following integration with blockchain.

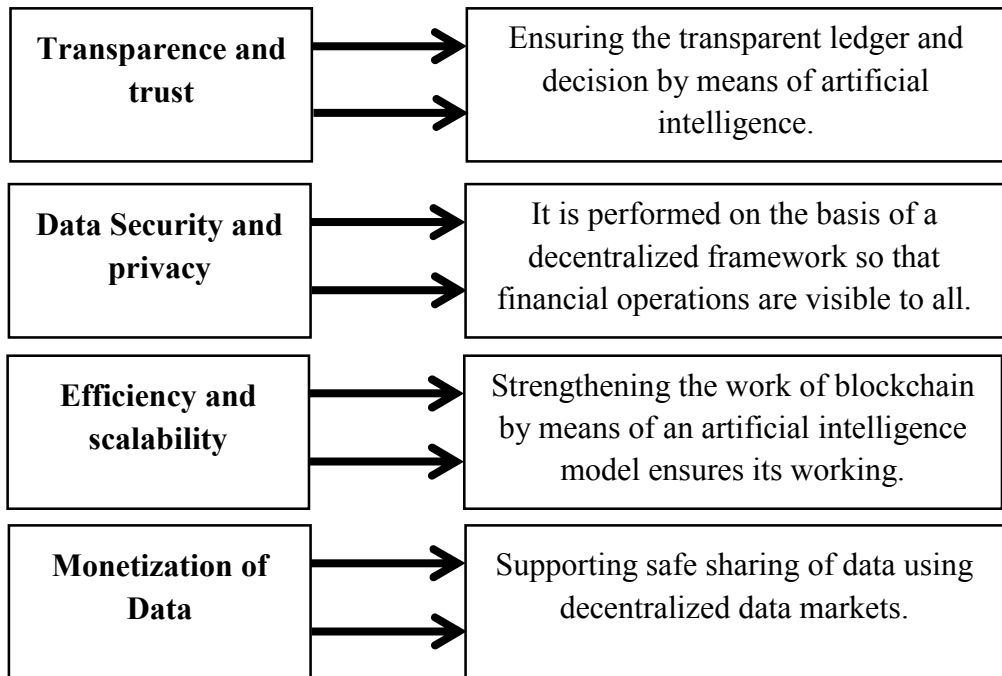
4- Integration of Artificial Intelligence and Blockchain

Artificial intelligence and blockchain could be achieved by offering a safe and transparent area to transfer and maintain information, together with its processing, which simplifies the implementation of the machine learning algorithms applied to dependable and tamper-proof data. It equally enables the possibility of data storage system with the use of P2P, where this tracking would make the data utilized in artificial intelligence one easily certifiable by its origin. It further addresses the fears that come with the exchange and sharing of personal data on a centralized network by allowing a different set of technologies like the one discussed under the name of Differential Privacy or the Multi-Party Computation (Varriale, Cammarano, Michelino, & Caputo, 2026).

This convergence has taken the form of decentralized artificial intelligence, which is a combination of artificial intelligence methodologies and blockchain, as a result of which the data is analyzed and a decision is made based on credible data, which is also traded in the blockchain, as a result of which the involvement of a third party disappears. In a nutshell, the process of integrating these two features explains that using artificial intelligence requires large scale of data whereas large scale of data can be stored safely in blockchain (Zhonghua, et al., 2021).



Fig N° 2: Integration on Artificial Intelligence and Blockchain



Source : A. Kuznetsov, P. Sernani, L. Romeo, E. Frontoni, and A. Mancini, “*On the Integration of Artificial Intelligence and Blockchain Technology: A Perspective about Security*,” *IEEE Access*, vol. 11, pp. 1–20, 2023, doi: [10.1109/ACCESS.2023.3349019](https://doi.org/10.1109/ACCESS.2023.3349019). P 3888.

5- Artificial Intelligence and Blockchain in Financial Sector

5.1- Supply Chain Management: To implement the stability of supply chains, they should be certain and proven that business operations and products meet particular conditions and standards (Grimm, Jörg H, Joerg S, Hofstetter, & Joseph, 2016). In adherence to this, majority of companies attempt to be in line with reality. Therefore, artificial intelligence and machine learning models help to promote more transparency in the supply chain operations, which is due to the combination with blockchain technology. Such incorporation has been especially noticeable following the COVID-19

pandemic, which demonstrated the insufficiency of the health systems provided by the majority of countries concerning the possibility to react to emergencies. The solution to such challenges has emerged as a combination of blockchain and artificial intelligence, thus, directing research towards pharmaceutical supply lines and medical supplies (Vincent, Ali, & Tatiana, 2023).

Other projects that combined the use of artificial intelligence and blockchain technology have produced successful models, IBM being one, which replaced its supply chains with cognitive supply chains that depend on artificial intelligence, data analysis, and cloud computing when making decisions, which resulted in a reduced cost.

Furthermore, IBM was also able to carry out complete order fulfilment amidst international upheavals and switched its conventional systems to one continuous system that promotes transparency of data. This system provided a visible view of transactions hence enabled quick responses, performance, and an in-depth look into the data (Corporation, 2022).

As an example, the system is also able to retrieve any factors that might cause delays in shipment, e.g., bad weather in a targeted region. It has also empowered IBM to handle bulk quantity of transportation activities without any problem due to its compatibility with blockchain technology that strengthened its manageability of risks in both transparent and stable manner, and embrace novel ways of working through AI enabled techniques (Pace, 2020).

It is possible to assume that the contribution of artificial intelligence and its capabilities to process and analyze data, as well as the blockchain technology that turns into an immutable transparent ledger, will allow recording the process in a transparent manner step by step since raw material is extracted and the final product is delivered to the consumer. Therefore, it eliminates the chances of counterfeiting or spoilage of the goods during provision.



5.2- Financial Services:

Some of the recent financial services that have to do with automation, i.e., it is not possible to apply a direct human input in the financial service, include the revolutionary hedge fund named as Numerai, which is a platform that deals with financial assets using different models of artificial intelligence and blockchain technology. The project is deemed the first of its kind to integrate blockchain technology and artificial intelligence to forecast stock prices on the financial market. It constructs machine learning models to forecast the stock market and it also memorizes the forecasts, which implies that it accumulates all the available forecasts and then picks the forecasts with high reliability. This procedure involves a number of steps (Numerai, N.D):

- **First Steps:** At this stage, the forecasts will be gathered by the data scientists entering the NMR token on the blockchain. This information is then transformed into machine learning and is worked on with respect to the markets.
- **Second Steps:** At this stage, results will also be ranked based on the best solution (the best solution by such individual will be termed as the grandmaster, followed by the masters or the top ten in case and then the experts down to the novices who have not entered any eligible prediction). The same happens periodically.
- **Third Steps:** The outstanding solutions are incorporated in this stage to carry out trades at the financial market.

NMR token is based on the block chain, but the advantage of the token about the block chain is that the transactions flowing in the chain are secured and transparent due to the block chain technology and the artificial intelligence will come in play to make decisions to invest in the financial market based on automated predictions (Numerai, N.D). Nonetheless, even in the conditions of this breakthrough and the potential of artificial intelligence to process the huge amount of data that can be found on the blockchain, it is extremely challenging in practice to make a correct prediction of the stock prices.

5.3- Risk Management:

This embedding will help blockchain to provide the precision and correctness of data. A survey carried out showed that due to blockchain, risk management will be improved by 40 percent (IBM Corporation., 2017). In another survey, it was reported that there was a reduction in risk, drop in expenditure and improvement in efficiency and noticed a tendency of being able to control money laundering activities (Capgemini Consulting, 2016). Also, artificial intelligence is able to read and categorize description of risks based on their effect and frequency as well as process and analyze large quantity of data and evaluate loans. This is done through combining loss data and risk reports and therefore ending up to give more accurate forecasts as compared to earlier forecasts and reduce risks. Thus, the application blockchain and artificial intelligence offers transparency, security, and confirmation of transactions (Lynn, Mooney, Rosati, & Cummins, 2019).

5.4- Smart Contracts and Automations:

This history of smart contracts goes back in the earlier 1990s by **Nick Szabo**, smart contracts can be defined as follows (Nick, 1996): “A collection of promises, a protocol that is automatically completed by computer network or other electronic computing approaches.” Artificial intelligence can, thus, be beneficial in many ways as far as smart contract processes are concerned due to the provision of appropriate contract management. As an example, in case of a delay in the expediency of supplying a product, artificial intelligence can determine the reason why this happens, in other words, transportation delay or inability of a debtor. It then publishes the information on the block chain. Once having established the cause of the problem, it can either reprimand the debtor in case of negligence, or eliminate the possibility of the system being plagued with the problem in the first place (Papadouli & Papakonstantinou, 2023).

6. challenges of Artificial Intelligence and Blockchain Integration

In as much as the addition of artificial intelligence and blockchain means additional value, there are associated challenges which can be



illustrated as follows (Addula, Meduri, Nadella, & Gonaygunta, 2024):

- **Scalability:** The scalability of financial operations can be considered one of the future challenges and problems. This issue of ensuring that processing of large quantities via blockchain and the artificial intelligence systems can burden computers and hence the possibility of the occurrence of imbalances due to the problem.
- **Security and Privacy:** One is not unaware of the fact that the primary benefit of combining blockchain with artificial intelligence is transparency. But other issues exist in terms of deception in the openness that may make and influence privacy and secrecy of blockchain in large or sensitive monetary transactions.
- **Data quality:** The artificial intelligence-based findings also need good and reliable data to be processed during training, and it can conflict with the blockchain systems, which can be incomplete or inaccurate.
- **Cybersecurity:** Blockchain is said to be secure, but there are possible vulnerabilities of smart contracts that allow financial systems to be subjected to various cyber-attacks.

Conclusion

The transformation that the world is experiencing in the financial sector is not just a modest tendency; it is a revolution, an approach strategy that is reorganizing the financial system. Artificial intelligence offers to provide high levels of analytics and prediction without significant mistakes and blockchain ensures that everything is transparent and secure in the process of handling transactions. It makes it not only possible to improve the financial sector by means of reducing its costs, to provide the transparency, and to manage the risks, but also introduces the new challenges, such as immense energy consumption necessitated by data processing, and legal issues in general.

Hypotheses:

1) AI models can process data and information which is awarded on the blockchain, consequently, resulting in the development of efficient systems that can identify fraud at a higher degree of accuracy. It is believed that AI models are effective in detecting frauds and since the blockchain records immutable data, it will guarantee that the data will be accurate and the AI models can process them efficiently. Nonetheless, the data in the blockchain does not come in the best possible form to train the models so it has to undergo some steps. As such, **the hypothesis is correct** yet it depends on the quality of the data.

2) The combination of AI models and blockchain technology helps produce the systems that will be able to forecast manipulations or anticipated crises. The possibility to create systems that are able to track the appearance of emerged risks, which is confirmed by using the available predictive models in the blockchain that is studied by AI models, can be seen as a confirmation of the hypothesis.

3) The combination of the two technologies helps to promote and enlarge financial inclusion with the production of better and secure digital procedures, at lesser costs of operation. The digital wallets and models of credit related to blockchain technology and AI models can offer a solution to the people, who have no access to banks, and this fact proves the validity of the hypothesis.

Bibliography List:

1. Books

- Hirsh, S., & Alman, S. (2020). Blockchain. American Library Association, 18.
- Lynn, T., Mooney, J., Rosati, & Cummins, M. (2019). Disrupting Finance: FinTech and Strategy in the 21st Century. Dublin, Ireland. doi:10.1007/978-3-030-02330-0
- Margaret A. Borden. (2018). Artificial Intelligence: A very short Introduction. Oxford University Press.



2. Journal Articles

- Addula, S., Meduri, K., Nadella, G., & Gonaygunta, H. (2024). AI and Blockchain in Finance: Opportunities and Challenges for the Banking Sector. *IJARCCCE*, 13(2). doi:10.17148/IJARCCCE.2024.13231
- Al Kuwaiti, A., Nazer, K., Al-Reedy, A., Al-Shehri, S., Al-Muhanna, A., Subbarayalu, A., . . . Al-Muhanna, F. (2023). A Review of the Role of Artificial Intelligence in Healthcare. *Journal of Personalized Medicine*, 951.
- Arinez, J., Chang, Q., Gao, R., Xu, C., & Zhang, J. (2020). Artificial Intelligence in Advanced Manufacturing: Current Status and Future Outlook. *Journal of Manufacturing Science and Engineering*. doi:10.1115/1.4047855
- Bai, L. (2021). Analysis of the change of artificial intelligence to online consumption patterns and consumption concepts. *Research square*, 13.
- Grimm, Jörg H, Joerg S, Hofstetter, & Joseph, S. (2016). Exploring sub-suppliers' compliance with corporate sustainability standards. *Journal of Cleaner Production*, 1971-1984.
- Kuznetsov, O., Sernani, P., Romeo, L., Frontoni, E., & Mancini, A. (2024). On the Integration of Artificial Intelligence and Blockchain Technology: A Perspective About Security. *IEEE Access*, 12, 3881-3897. doi:10.1109/ACCESS.2023.3349019
- Papadouli, V., & Papakonstantinou, V. (2023). A preliminary study on artificial intelligence oracles and smart contracts: A legal approach to the interaction of two novel technological breakthroughs. *Computer Law & Security Review*, 51, 105869. doi:10.1016/j.clsr.2023.105869
- Russell, B. (1977). Artificial Intelligence: The New Frontier. *Datamation*, 109.
- Varriale, V., Cammarano, A., Michelino, F., & Caputo, M. (2026). Artificial intelligence in technology networks: A catalyst for achieving the SDGs. *Technovation*, 103398. doi:10.1016/j.technovation.2025.103398
- Vincent, C., Ali, E., & Tatiana, G. (2023). A critical analysis of the integration of blockchain. *Annals of Operations Research*, 8-47.
- Xiaotong, C., Songlin, H., Linfu, S., Yangxin, Z., & Chase Q, W. (2024). A Survey of Consortium Blockchain and Its Applications. *Cryptography* 8.2.
- Zheng, W., Zheng, Z., Chen, X., Dai, K., Li, P., & Chen, R. (2019). NutBaaS: A Blockchain-as-a-Service Platform. *IEEE Access*, 134422-134433. doi:10.1109/ACCESS.2019.2941905
- Zhonghua, Z., Xifei, S., Lei, L., Jie, Y., Yu, W., & Dapeng, L. (2021). Recent Advances in Blockchain and Artificial Intelligence Integration: Feasibility Analysis, Research Issues, Applications, Challenges, and Future Work - Zhang - 2021 - Security and Communication Networks - Wiley Online Library. *Security and Communication Networks*, 9991535.

3. Reports (Institutional / Industry Reports)

- Capgemini Consulting. (2016). Smart contracts in financial services: Getting from hype to reality. Capgemini Consulting. Retrieved from https://www.capgemini.com/es-es/wp-content/uploads/sites/16/2022/12/smart_contracts_in_fs.pdf
- IBM Corporation. (2017). Financial services: Building blockchain one block at a time. Cognizant.
- Tobias, A. (2024, september 6). Artificial Intelligence and its Impact on Financial Markets and Financial Stability. Retrieved from IMF: <https://www.imf.org/en/News/Articles/2024/09/06/sp090624-artificial-intelligence-and-its-impact-on-financial-markets-and-financial-stability>

4. Working Papers / Preprints / Conference Papers

- Crosby, M., Nachiappan, Pattanayak, P., Verma, S., & Kalyanaraman, V. (2015). Blockchain Technology: Beyond Bitcoin. Berkeley University of California. Retrieved from <https://scet.berkeley.edu/wp-content/uploads/AIR-2016-Blockchain.pdf>
- Dinh, T., Wang, J., Chen, G., Ooi, B., & Tan, K.-L. (2017). BLOCKBENCH: A Framework for Analyzing Private Blockchains. arXiv. doi:10.48550/arXiv.1703.04057
- Guegan, D. (2017). Public Blockchain versus Private blockchain. Centre d'Économie de la Sorbonne., 8.
- Xing, B., & Marwala, T. (2018). Blockchain and Artificial Intelligence. arXiv. doi:10.48550/arXiv.1802.04451
- Nick, S. (1996). Smart contracts: building blocks for digital markets. EXTROPY: The Journal of Transhumanist Thought, 28.

5. Web Sources / Online Articles / Documentation

- AWS. (2025). What is Artificial Intelligence. Retrieved from Amazon: <https://aws.amazon.com/what-is/artificial-intelligence/>
- Corporation, I. B. (2022, July). IBM builds its first cognitive supply chain. Retrieved from IBM: <https://www.ibm.com/case-studies/ibm-supply-chain>
- Crooks, N. (2023, 08 23). What are blocks in a blockchain. Retrieved from THE BLOCK: <https://www.theblock.co/learn/245697/what-are-blocks-in-a-blockchain>
- Hooda, P. (2025, 09 17). Centralized vs. Decentralized vs. Distributed Systems. Retrieved from GeeksforGeeks:



<https://www.geeksforgeeks.org/system-design/comparison-centralized-decentralized-and-distributed-systems/>

- McGrath, A., & Downie, A. (2025). artificial intelligence (AI) in finance. Retrieved from IBM: <https://www.ibm.com/think/topics/artificial-intelligence-finance>
- Numerai. (N.D). Overview. Retrieved from Numerai docs.: <https://docs.numer.ai/>
- Pace, G. (2020, May 17). IBM Watson: how AI is transforming the supply chain. Retrieved from Supply Chain Digital: <https://supplychaindigital.com/technology/ibm-watson-how-ai-transforming-supply-chain>