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Applications of Artificial Intelligence in Banking Services - International Experiences –

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Summary :
This study aims to identify the key applications of artificial intelligence in banking services and analyze selected international experiences in this field. It also seeks to highlight the extent to which this technology contributes to improving banking efficiency and enhancing the quality of services provided to customers. The study finds that artificial intelligence is widely used in fraud detection, risk management, data analysis, customer service, and creditworthiness assessment. The results indicate that its adoption contributes to reducing costs, accelerating banking operations, improving customer experience, and supporting more appropriate decision-making.
The study further concludes that the successful implementation of these applications requires advanced digital infrastructure, specialized expertise, appropriate regulatory frameworks, and effective measures to ensure data security and customer privacy.
Keywords : Artificial Intelligence, Banking Services.
Jel Classification Codes: O33, G21.

Introduction:

In recent years, the world has witnessed rapid development in the field of technology and innovation, and artificial intelligence has become one of the most prominent modern technologies affecting various economic and service fields. The banking sector is one of the sectors that benefits most from these developments, due to its heavy reliance on data and financial transactions, as employing artificial intelligence has become an important means of improving the efficiency of banking operations, developing services, and responding better to customer needs.

The spread of artificial intelligence technologies, such as machine learning, big data analysis, natural language processing, and smart assistants, have led to clear changes in the nature of banking services. Banks are no longer limited to providing traditional services, but rather have become dependent on smart solutions in the areas of fraud detection, creditworthiness assessment, risk management, customer service, and predicting their behavior, which allows improving the quality of services, accelerating operations, and reducing costs.

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Despite the advantages provided by artificial intelligence, its application in banking services faces a number of challenges, most notably data security and privacy, cybersecurity risks, high investment costs, lack of specialized competencies, and legal and ethical challenges associated with the use of smart systems. Hence the importance of studying international experiences to understand how to employ artificial intelligence and benefit from its advantages while reducing its risks.

-Problem of the study:

Based on the above, the following main problem can be raised:

To what extent do artificial intelligence applications contribute to the development of banking services?

This problem includes a number of sub-questions:

-What are the most important applications of artificial intelligence in banking services ?

-What are the most prominent international banking experiences in employing artificial intelligence ?

-What are the most important challenges of using artificial intelligence in the banking sector ?

-What are the most prominent challenges facing the application of this technology?

Study hypotheses:

The study starts from the following main hypothesis:

The application of artificial intelligence contributes to the development of banking services, improving their efficiency and quality, and enhancing risk management and customer service. However, its application faces a set of technical, regulatory and security challenges.

Study objectives:

The study aims to:

-Learn about the concept of artificial intelligence and its most important characteristics .

-Highlighting the most important applications of artificial intelligence in banking services.

-Learn about some international experiences in using artificial intelligence in banks .

-Identifying the most prominent challenges and risks associated with its application.

Importance of the study:

The importance of the study lies in the increasing role of artificial intelligence in developing the banking sector in light of the accelerating digital transformation. It also gains its importance from the possibility of benefiting from international experiences in identifying best practices related to the use of artificial intelligence, which helps banking institutions improve their services and enhance their competitiveness.

Study methodology :

The study relied on the descriptive analytical approach, by presenting concepts related to artificial intelligence and banking services, analyzing its most important applications in the banking sector, then presenting and analyzing a group of international experiences with the aim of extracting the most important results, practices and challenges associated with employing this technology.

Previous studies :

-Study (Ikram and Amina, 2023) entitled **"The impact of artificial intelligence on the performance of commercial banks (a case study of commercial banks in the states of El Bayadh and Tiaret)."** The study aimed to identify the role and impact of artificial intelligence in

the financial field, and the extent of its contribution to improving the performance of commercial banks and increasing their profitability. The study was conducted on a group of commercial banks in the states of El Bayadh and Tiaret, by distributing a questionnaire to a sample of 100 employees. The data were analyzed using SPSS and AMOS programs, relying on structural equation modeling to test the study hypotheses. The results found a significant impact of artificial intelligence on the performance of commercial banks.

-**Study** (Reham, 2022) entitled **"The Role of Artificial Intelligence in Improving the Performance of Banking Services."** The study aimed to identify the role of artificial intelligence in improving the performance of banking services, considering technology one of the most important components of the contemporary business environment and a basis for enhancing opportunities for survival, growth, and continuity. The researcher relied on the descriptive analytical approach, and the study concluded that employing smart machines contributes to reducing risks and pressures on workers, and enabling them to focus on the most important tasks, especially by assigning arduous and repetitive work to smart systems. The study also recommended the need to organize training programs for bank employees to develop their ability to deal with artificial intelligence applications in a way that contributes to achieving the strategic goals of banks.

-**Study** (Jamila, 2026) **"Entitled Artificial Intelligence and its Role in Developing Banking Services: A Case Study of the Algerian Popular Credit Bank (CPA)."** The study aimed to highlight the importance of artificial intelligence in developing banking services and improving banks' performance and profitability, while studying the experience of the Algerian Popular Credit Bank (CPA). The results showed that employing smart technologies contributed to accelerating and facilitating operations and improving customer experience. Artificial intelligence also represents an important pillar for supporting digital transformation and enhancing the competitiveness of banks. However, its implementation in Algeria faces challenges, most notably weak infrastructure and a lack of specialized competencies. Therefore, the success of this transformation requires increased investment in technology and the qualification of human resources.

-**Study** (Loso, 2024) entitled **"ARTIFICIAL INTELLIGENCE IN BANKING: THE FUTURE OF DIGITAL FINANCIAL SERVICES"**, the study aimed to analyze the role of artificial intelligence in developing digital banking and financial services, by highlighting its applications in improving the efficiency of banks, the quality of their services, and enhancing their interaction with customers. The study found that artificial intelligence has great potential to develop the banking sector and improve its performance, but its application faces challenges related to regulation, privacy, and ethics. The results emphasized the importance of achieving a balance between innovation and control, while adopting controls and regulatory frameworks that ensure the safe and responsible use of this technology.

1. Artificial Intelligence.

1- Definition of artificial intelligence: The term artificial intelligence was coined by John McCarthy in 1955, and he defined it as **"the science of engineering intelligent machines, especially computer programs, which is based on creating computer programs and devices**

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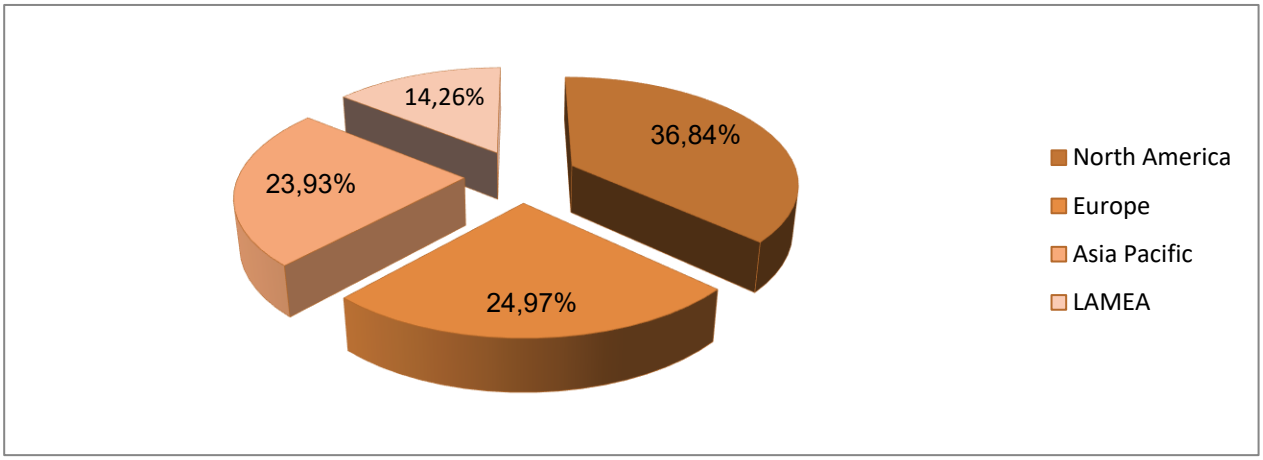
capable of thinking in the same way that the human brain works and simulating the actions of humans." (Zarrouqi and Amira, 2020, page 5)

It is also known as 'a set of theories and techniques used to develop machines and systems capable of simulating human intelligence, by employing advanced algorithms that allow providing effective, reliable, and customized answers and solutions to users. Artificial intelligence depends on the integration between hardware and software, and is also based on employing multidisciplinary knowledge, including electronics, computer science, and mathematics, with the aim of developing systems capable of processing information, learning, and making decisions in a way that mimics human capabilities.' (Ikram and Amina, 2023, page 36)

As Dan Patterson believes, **"Artificial intelligence is one of the branches of computer science, and is concerned with developing computer systems that mimic some aspects of human intelligence. These systems are distinguished by their ability to analyze problems and draw useful conclusions about them, in addition to the ability to simulate some human capabilities, such as perception and understanding, enabling them to perform tasks that usually require a degree of human intelligence."** (Lydia, 2023-2024, page 07)

The size of the artificial intelligence market has developed across several regions of the world, as shown in the following figure:

Figure No. (01): Artificial Intelligence market size by region in 2022



Source: (precedenceresearch, 2023)

Through Figure No. (01), we notice that the North American region captured the artificial intelligence market by 36.84%, as it is the most developed region, in addition to being distinguished by the technological cultural awareness of its citizens, followed by the European region by 24.97%, which is also a region characterized by development that has contributed to the use of various digital technologies, including artificial intelligence technology in its various economic fields, then the Asian region by 23.93% .

1.2 The importance of artificial intelligence .

The importance of artificial intelligence is represented in a number of aspects, the most prominent of which are (Jamila, 2026, p. 134):

•It is one of the most important engines of economic and technological development and growth, and represents one of the components of future prosperity.
•It helps individuals, governments, and institutions to simplify transactions and improve the efficiency of their management.
•It contributes to supporting economic development and enhancing financial inclusion by expanding access to services.
•It works to reduce operational costs, raise the efficiency of institutions, and improve their productivity.
•It allows tasks to be completed more quickly, and contributes to facilitating communication and exchange of information.
•It is characterized by its ability to process huge amounts of data, store it, and retrieve it when needed.
•It contributes to increasing revenues and achieving greater profits by providing accurate analyzes and information that support decision-making.
•Reduces reliance on human intervention in some tasks, especially routine and repetitive operations.
•It represents a wide field for innovation and development, and opens new horizons for various sectors in the future.
•Its applications are numerous and include various fields, including education, technology, the military sector, finance, medicine and other fields.

1.3 **Characteristics of artificial intelligence .**

Artificial intelligence has several characteristics, including (Diab, 2022, page 77) :

- Applying artificial intelligence to devices to enable them to plan and analyze problems using logic.
- He has the ability to recognize sounds and speech, and to move objects.
- He has the ability to process a huge amount of information to which he is exposed.
- Learning and understanding through the use of previous experiences and expertise.
- The ability to acquire and apply knowledge.
- Artificial intelligence is characterized by the ability to respond quickly to situations, as it can deal with difficult and complex situations.

1.4- **Types of artificial intelligence**

Artificial intelligence can be divided into three main levels, which differ in terms of the degree of capabilities and functions that it can perform (Asmahan, 2025, p. 27):

- Narrow artificial intelligence: It is specialized in performing specific tasks within a specific field, such as chatbots and voice assistants, and it cannot go beyond the tasks for which it was designed.
- General Artificial Intelligence: It aims to simulate human capabilities in learning, analysis, problem solving, and decision-making, with the ability to benefit from previous experiences without direct human intervention.

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- Super artificial intelligence: It represents a hypothetical level in which artificial intelligence exceeds the mental capabilities of humans in various fields. It is still under research and development and has not been achieved in practice yet.

1. Banking services.

2.1- Definition of banking services: Banking services are defined as a set of financial operations and transactions provided by banks to meet the needs of customers. These services vary according to the type of bank and the nature of its customers, and the most important of them include granting credit, savings accounts and current accounts, in addition to payment and transfer services and other financial services. (Reham, 2022, page 73)

It is also defined as "a group of activities and operations with a utilitarian content inherent in the tangible and intangible elements provided by the bank, which customers perceive through their utilitarian features and values and which constitute a source of satisfying their current and future needs and desires and at the same time constitute a source of the bank's profits" (Saeed, 2021, p. 136) .

2.2- Types of banking services:

There are several types of banking services, including traditional and modern ones, which we mention as follows (Al-Hajj, Amina, and Khadija, 2019, page 64) :

-Accepting deposits: It is considered one of the oldest and most important banking services, as banks accept deposits from individuals and institutions, including current accounts, savings accounts, money market deposit accounts, certificates of deposit, and negotiable payment orders, which contributes to providing funding sources for banks and achieving returns through some of these accounts and services.

Providing credit facilities: Providing financing to individuals and institutions through various forms of credit facilities, including loans, advances and in-kind facilities, in addition to non-cash facilities such as opening documentary credits, with the aim of meeting the financing needs of customers and supporting their economic activities.

-**Investing in securities and investment projects**: Banks invest part of their funds in securities, such as government bonds and treasury bills. They can also contribute to the capital of some banks and other institutions, which helps them diversify their investments and achieve additional returns.

-**Traditional banking services**: It includes a group of daily services that banks provide to their customers, such as buying and selling foreign currencies, opening accounts in foreign currencies, cashing checks, making foreign transfers, paying customers' obligations to others, in addition to disbursing wages and salaries to employees of institutions dealing with the bank.

-**Modern banking services**: These services emerged as a result of technological development in the banking sector, and they aim to improve the quality of services, meet customer needs, and increase banks' efficiency and returns. The most prominent of which are electronic payment cards, points of sale, ATMs, electronic funds transfer, smart cards, investment and insurance trustee services, and investment funds.

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2.3- Characteristics of banking services :

There are several characteristics, including (Abdul Hamid, Maysoon, and Abd al-Hamid, 2025, p. 692) :

- **Intangibility:** The banking service cannot be seen, touched or stored, but is perceived through the benefits that the customer obtains when using it.
- **Inability to separate the service**: It is difficult to separate the banking service from its provider, because its provision depends to a large extent on the customer's interaction with the bank.
- **Geographical expansion**: The bank can expand the base of beneficiaries of its services through expansion and opening new branches, which contributes to increasing its spread in the banking market.
- **Production and consumption of the service at the same time**: Banking services are characterized by their production and consumption at the same time; The bank provides the service and the customer consumes it at the same moment.
- **Repurposing the banking service**: Some banking services are characterized by the possibility of repurposing the funds obtained by the bank, such as repurposing deposits in the form of loans or investments.
- **Banking services cannot be stored**: The banking service cannot be stored for use at a later time, as it is provided when the customer requests it.
- **Maintaining similarity**: In the case of similar banking services, the bank seeks to provide a service that achieves customer satisfaction and maintains its competitiveness.
- **Demand fluctuations**: Demand for banking services is affected by changing customer behavior and needs, which requires banks to constantly adapt to these changes.
- **Fiduciary responsibility**: The bank bears the responsibility of protecting customers' deposits and funds, especially when providing credit banking products and services.
- **The equation between growth and risk**: Banks must achieve a balance between expansion and growth in their products and services and maintaining an appropriate level of risk.
- **Use of electronic means**: The development of banking activities requires reliance on modern electronic means and technologies to implement banking services efficiently and quickly.
- **Diversity of banking services**: Financial and banking institutions seek to provide a variety of services to meet customer needs, achieve their satisfaction, and enhance their competitiveness.

2. Artificial intelligence applications in banking services .

There are several applications of artificial intelligence in banking services, including (Srivastava S., 2024):

- Cybersecurity and fraud detection: With the development of banking transactions into digital transactions that take place over the Internet, such as paying bills and withdrawing money, the need has emerged for applications to detect fraud, and here the role of artificial intelligence in banking services is highlighted, as artificial intelligence and machine learning have helped

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banks identify fraudulent activities through Know Your Customer (KYC) and anti-money laundering (AML) processes, by automating many transaction verification and monitoring procedures, filling gaps in systems, reducing risks, and improving the overall security of online banking services.

As an example, Danske Bank, the largest bank in Denmark, uses artificial intelligence to detect fraud by implementing algorithms in its business. Deep learning technology has increased the bank's ability to detect fraud by 50%, and reduced false positives by 60%. This system automates many critical decisions before directing cases to a human analyst for further examination and accuracy.

-**Cyber Threat Management**: Artificial intelligence helps banks confront cyber threats. In 2019, cyber attacks in the financial sector were estimated at 29% of total attacks, and with the adoption of artificial intelligence in banking services, banks are able to respond to potential cyber attacks before they affect customers, employees, or the banks' internal systems.

-**Chatbots**: They are tools based on artificial intelligence in banking services, and allow customer needs to be met and their inquiries answered 24 hours a day, 7 days a week. Unlike the human element, chatbots work non-stop and help efficiently understand customer behavior and requirements. They also provide support and guidance in various banking services. One of the most prominent examples of this is "Erica," a virtual assistant powered by artificial intelligence for Bank of America, as it manages more than 50 million requests, which reduces costs and shortens time for the bank.

As an example, we mention the intelligent virtual assistant "Eno": "Eno" is the best intelligent virtual assistant in "Capital One", and it is one of the most prominent examples of artificial intelligence in personal banking services. In addition to Eno, Capital One also uses virtual card numbers to prevent credit card fraud, and the bank is working on "computational creativity" to train computers to be creative and interpretable.

-**Loan and credit decisions**: Banks have become dependent on artificial intelligence to make safer and more profitable decisions regarding loans and credit, instead of relying on the creditworthiness of the individual in the traditional way. The robotic process automation system supported by artificial intelligence (RPA) works to automate repetitive tasks, such as processing requests, settling accounts, and preparing reports, by studying customer behavior and patterns. Artificial intelligence is also used in investment portfolio management and algorithmic trading, which helps banks determine which customers deserve financing, and those who... They may pose a risk of non-payment. This technology represents a future change in the field of consumer lending, and this allows for faster and more investment decisions based on the information issued by the use of artificial intelligence technology.

-**Tracking market trends**: Artificial Intelligence and Machine Learning (AI-ML) helps banks analyze huge amounts of data and predict the latest future market trends, which contributes to providing more profitable investment suggestions.

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Data collection and analysis: Collecting and analyzing data in banks has become a cumbersome process for employees, with the possibility of errors in recording due to pressure.

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Therefore, it has become necessary to use artificial intelligence that collects, stores, and analyzes data, which helps in making appropriate and timely decisions.

-**Increasing operational efficiency through process automation**: This is done through RPA (Robotic Process Automation) technology, which relies on robotic algorithms to automate banking processes. The use of this technology has increased operational efficiency, reduced costs, reduced time, and ensured accuracy.

Banks' reliance on various applications of artificial intelligence to improve their administrative and credit methods has increased their spread, which has led to an increase in the market share of this technology in the banking sector, as shown in the following figure:

Figure No. (02): The size of the artificial intelligence market in banks in the period 2022-2032.

Source: (Bevz, 2024)

Through Figure No. (02), we review the size of the artificial intelligence market in banks, as it reached 10.79 billion US dollars in 2022, and is expected to reach 118.06 billion US dollars by 2032. This double growth results from the multiple uses of artificial intelligence in banks and its dissemination in various transactions, services and banking products.

4. International experiences of artificial intelligence applications in banking services:

There are several banks in the world that have adopted artificial intelligence technology in providing their banking services, and we will mention some of them:

Citi Bank experience: (Citi Bank) Citi Bank uses logistic regression models, which are applications of artificial intelligence and machine learning, to identify customers most likely to respond to banking products and target them with appropriate offers. The bank also uses these models to determine prices for eligible customers according to the degree of risk and probability of response. In addition, machine learning is used to improve cash management in ATMs by predicting cash demand and determining appropriate liquidity levels, which has contributed to reducing unused cash in the ATM network by about 15%. (Technology, 2020, p. 21)

The experience of Argentine banks: The Konfio application was developed based on artificial intelligence techniques, with the aim of facilitating small enterprises' access to credit. The application allows financing requests to be processed and funds disbursed within a period of up to

24 hours, with a late payment rate recorded at approximately 3.1%, which reflects the effectiveness of artificial intelligence in analyzing customer data, assessing their credit capacity, and making financing decisions quickly. (Metwally, 2024)

Punjab National Bank: The bank has established an internal data analysis center with the aim of taking advantage of big data, artificial intelligence and machine learning in developing banking products and operations. It uses these technologies to attract customers, manage campaigns and channels, analyze customer sentiment to improve their satisfaction, encourage the use of digital services, improve the performance of branches, operations and customer service, in addition to risk management and compliance, and detect and prevent fraud. (Technology, 2020, p. 17)

The experience of United States banks: Several American banks have used artificial intelligence technologies in various fields, as Deutsche Bank relies on artificial intelligence to analyze investment portfolios, select appropriate assets, funds, and stocks for clients, and provide investment recommendations. ING Group also uses these technologies to assess customers' creditworthiness and predict the probability of default, while Wells Fargo uses artificial intelligence to detect fraud and corruption and analyze information that should be disclosed to regulators, which contributes to improving risk management and enhancing the efficiency of banking services. (Metwally, 2024)

Santander Bank experience: Santander Bank has developed an artificial intelligence tool in risk management called “Capros”, which explains how a customer can be affected by economic events. This tool creates predictive patterns that enable employees to make smarter investment and lending decisions. (Fernández, 2023)

TymeBank experience: TymeBank in South Africa relied heavily on artificial intelligence technologies to improve financial services and increase its customer base, especially by targeting financially excluded groups. The use of these technologies contributed to providing financial products and services at a lower cost and with higher quality, in addition to facilitating customers’ access to the services they need. Reducing operating costs also led to enhancing the bank’s competitiveness and attracting more customers compared to traditional banks.

China Construction Bank experience: The bank relied on modern technologies such as artificial intelligence, facial recognition, virtual reality, and smart robots to develop its banking services. Its branches are equipped with smart devices and robots capable of receiving customers, answering their inquiries, and providing services such as opening accounts, transferring money, changing currencies, investing, and wealth management. These technologies can also process about 90% of cash and non-cash requests, which contributes to accelerating service delivery, improving customer experience, and reducing reliance on traditional banking procedures. (Metwally, 2024)

The Bank of America experience: A platform based on artificial intelligence technology was created in this bank under the name “Glass”, which aims to help sales and trading employees uncover hidden market patterns. This platform anticipates clients' needs by unifying market data across different asset classes with the bank's internal models and machine learning technologies. (Fernández, 2023)

6. Challenges of artificial intelligence applications in banking services :

In applying artificial intelligence technology, banks face several challenges, including (Glass, 2024):

- **Data quality and availability:** Banks need accurate, complete and reliable data to operate artificial intelligence systems efficiently, but the dispersion of data within banking systems and the difficulty of integrating it may affect the quality of results and the accuracy of decisions.
- **Risk management and compliance**: The use of artificial intelligence may introduce new risks, such as algorithm bias and model errors, requiring banks to develop effective mechanisms for governance, risk management and monitoring of systems performance.
- **Transparency and interpretability**: Banks face difficulty in interpreting some of the decisions made by artificial intelligence models, especially "black box" models, which requires enhancing transparency and clarifying the foundations of decisions related to loans, credit, and risk assessment.
- **Legal and Ethical Considerations**: The use of artificial intelligence poses challenges related to protecting customers' privacy and financial data, reducing bias and discrimination, and ensuring fairness, transparency, and accountability in banking decisions.
- **Cybersecurity**: Relying on artificial intelligence increases the importance of protecting banking data from hacking and electronic attacks, which requires the use of encryption techniques and the strengthening of protection systems and continuous security monitoring.
- **Operational and strategic challenges**: Implementing artificial intelligence requires significant investments to modernize banking infrastructure and systems, in addition to reskilling employees and developing their skills in line with rapid technological developments.
- **Regulatory compliance and legal framework**: Banks face challenges due to multiple laws and regulations related to data, privacy, and artificial intelligence, which requires them to update their control and compliance systems and cooperate with regulatory authorities to ensure the legal and responsible use of this technology.

Conclusion :

In conclusion, artificial intelligence is one of the most important modern technologies that have contributed to the development of banking services, by improving their quality and speed of delivery, enhancing risk management and fraud detection, and raising operational efficiency. However, banks face several challenges related to data quality, cybersecurity, privacy, talent shortages, and regulatory compliance. Therefore, the success of employing artificial intelligence requires providing an appropriate digital infrastructure, qualifying human resources, and enhancing governance and security, to ensure that this technology can be used effectively and safely.

Most important results:

- Artificial intelligence contributes significantly to improving the quality and speed of banking services.

- Employing artificial intelligence technology in banks works to increase operational efficiency and reduce costs.
- It also enhances risk management and fraud detection.
- Adopting AI technology in banks comes with several challenges related to data, security, efficiencies and regulation.

The most important recommendations:

•In order to better employ artificial intelligence applications, the digital infrastructure of banks must be developed.

•Working to enhance data protection and cybersecurity in banks.

•Training and qualifying human resources in the field of artificial intelligence.

•Establishing clear legal and ethical frameworks for the use of artificial intelligence.

•Encouraging innovation and cooperation between banks, technology institutions and universities.

7. Appendices:

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