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**Research Article**

# Modern Trends In Artificial Intelligence For The Banking Sector: A Case Study Of Algeria

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**ABSTRACT**

This study aims to explore artificial intelligence (AI) technology and its various applications in the Algerian banking sector, a key driver of the economy. It also seeks to understand the advancements and modern trends in AI, highlighting its importance in enhancing the banking sector and its contribution to increasing profitability by improving financial services and performance. This includes facilitating customer experience and providing stronger data protection to prevent fraud and forgery. The study's findings indicate that although Algeria has made noticeable efforts to implement AI technologies, there has not been significant progress or widespread adoption. This is due to the lack of societal awareness and acceptance of such advancements, as well as deficiencies in the communication and information infrastructure. Therefore, it is essential to look to the experiences of countries that have proven successful in this field, focus on applying AI across all sectors, and leverage its benefits to keep pace with global changes.

**Keywords:** Artificial Intelligence, Banking Sector, Financial Services, Data Protection.

## Introduction

The banking sector is one of the most crucial pillars of the economy, facilitating the flow of money that finances various investments to achieve economic and local development and increase growth rates. Today, the world is witnessing rapid changes in information systems, with advancements across all fields including digitization and innovation in artificial intelligence (AI). This has led to the development of intelligent systems that can be programmed to perform tasks that mimic human intelligence, driving banks worldwide to keep pace with modernization. This allows them to offer distinguished services in the financial and banking sector, thanks to AI's high efficiency in transforming traditional financial services, improving the quality of financial transactions, and enhancing customer proximity with unmatched precision and efficiency. AI enables banks to better predict customer behavior, create superior offers based on this information, and improve the performance and profitability of financial institutions.

The banking sector is highly competitive, and banks need to stay ahead. AI plays a crucial role in the current technological transformations in financial services provided by financial institutions. Therefore, Algeria must adopt such technologies to keep up with global developments, transitioning from traditional government intervention policies to policies of liberalization and openness. This necessitates emulating and keeping pace with technological transformations to successfully integrate into the global economy.

Based on the above, the following research question arises: What are the modern trends in the application of artificial intelligence in the banking sector? (With reference to the case of Algeria)

To answer this research question, the study is divided into the following sections:

1. Basic concepts of artificial intelligence.
2. Applications of artificial intelligence in banking services.
3. Towards adopting AI tools in the Algerian banking sector.

## First: Basic Concepts of Artificial Intelligence

1. **Definition of Artificial Intelligence:** According to John McCarthy, the father of artificial intelligence, AI is "the science and engineering of making intelligent machines, especially intelligent computer programs." AI involves designing a computer or a robot controlled by a computer, or developing software to make computers think intelligently like humans. AI is also defined as a combination of cognitive

automation, machine learning, reasoning, hypothesis generation and analysis, natural language processing, and intentional algorithmic mutation, resulting in insights and analyses akin to or surpassing human intelligence (1).

**2. Types of Artificial Intelligence:** AI is classified based on its capabilities into three types (2):

**I. Types of AI by Intelligence Levels:**

a) **Weak AI:** Relies on simple computer algorithms programmed by humans, but this does not make computers intelligent despite their intelligent behavior.
b) **Strong AI:** Indicates that the computer's intelligence level matches human intelligence as it can efficiently handle any difficulties. However, this level has not yet been achieved due to the complex nature of the human mind.
c) **Super AI:** Still under study, aims to surpass human intelligence and find unconventional solutions to problems that the human mind cannot address. Current research is focused on creating electronic minds that compete with and outperform the human mind in all fields.

**II. Types of Artificial Intelligence by Fields of Use/Applications:**

The AI market encompasses six main sectors as follows:

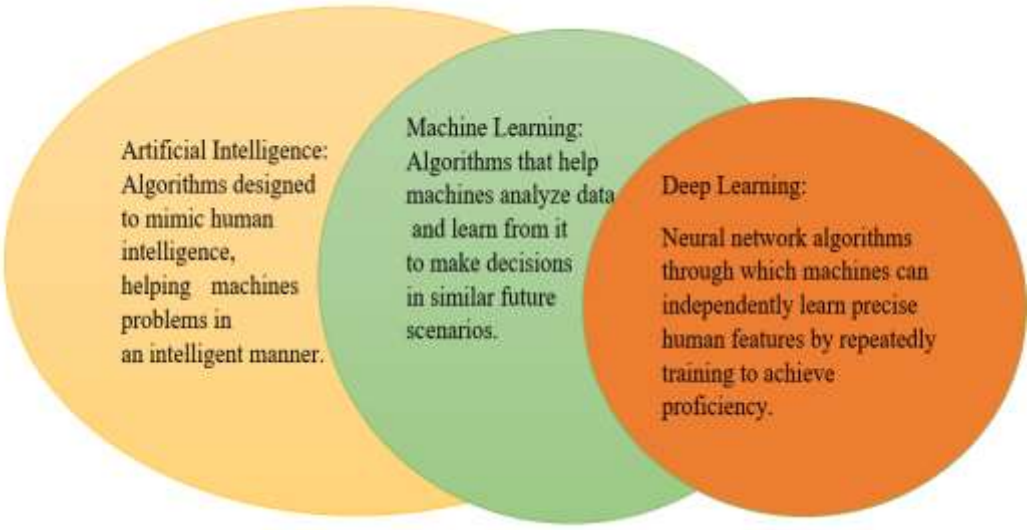
a) **Machine Learning:** This is the science through which a machine can translate, execute, and verify data using algorithms developed through complex mathematical capabilities, encoded in a language that the machine understands. It aims to solve some of the problems humans face, such as: (software for estimating and managing transportation, intelligent email programming, banking and personal finance software, social media software, smart assistant devices, etc.).
b) **Neural Networks:** This involves integrating cognitive sciences and machines to perform specific tasks by simulating the function of the brain's nervous system. It is a type of AI application that combines neuroscience and AI to easily solve many complex tasks.
c) **Robotics:** These applications are based on the integration of various scientific disciplines, mechanical engineering, electrical engineering, computer science, and other sciences. Robotics is concerned with the design, production, and use of robots, their production and operation, and the handling of computer systems that control them. Robots are used in fields that are arduous for humans.
d) **Expert Systems:** The first appearance of expert systems based on AI techniques was in the 1970s, with significant development in the 1980s. These systems employ AI to simulate decision-making systems that rely on human intelligence to handle complex problems through logical reasoning.
e) **Fuzzy Logic:** These applications analyze and modify uncertain information and handle uncertainty by measuring the degree of truth of different hypotheses. It is also used to analyze uncertainty based on the logical reasoning of the human mind. Fuzzy logic systems integrate human reasoning with decision-making systems.
f) **Natural Language Processing (NLP):** This field is dedicated to developing advanced methods that facilitate the interaction and communication between machines and human languages, such as English. This includes translation, text recognition, content analysis, and understanding the human emotions conveyed.

**III. Types of Artificial Intelligence by Level of Data Use:**

AI systems are classified by the level of data use and processing into three levels as follows:

a. Machine Learning
b. b. Deep Learning
c. c. Artificial Intelligence

**Figure 1:** Types of Artificial Intelligence by Level of Data Use and Analysis




Source: IBM. "AI, Machine Learning, and Deep Learning: What's the Difference?"
**Source: IBM. "AI, Machine Learning, and Deep Learning: What's the Difference?**

### 3. Characteristics of Artificial Intelligence

Artificial intelligence (AI) is based on creating intelligent machines that behave like humans and use a human-like approach to problem-solving. It also deals with hypotheses simultaneously with high accuracy and speed. AI possesses many characteristics and advantages, including (3):

- Utilizing, perceiving, acquiring, and applying knowledge.
- Learning and understanding from past experiences.
- Using old experiences and applying them to new situations.
- Quickly responding to new situations and conditions.
- Handling difficult and complex cases.
- Managing ambiguous situations with missing information.
- Recognizing the relative importance of elements in known cases.
- Visualizing, innovating, and understanding and perceiving visible matters.
- Providing information to support decisions.

### Some of the key features of AI applications include:

- Operating at a consistent scientific and advisory level without fluctuation.
- Requiring the representation of vast amounts of knowledge specific to a particular field.
- Processing symbolic, non-numerical data through logical analysis and comparison.
- Aiming to simulate human thinking and methods.
- Focusing on generating new ideas that lead to innovation, preserving human expertise.
- Offering multiple system copies and compensating for experts, eliminating human fatigue and boredom.

### 4. Objectives of Artificial Intelligence:

The objectives of AI include (5):

- Replicating human intelligence.
- Solving knowledge-intensive tasks.
- Creating intelligent connections between perception and action.
- Enhancing human-human and human-computer interaction.
- Enabling machines to process information in a manner similar to human problem-solving, i.e., parallel processing, where multiple commands are executed simultaneously.
- Gaining a better understanding of human intelligence by unraveling the mysteries of the brain to simulate it. It is well-known that the nervous system and the human brain are the most complex organs, working interconnectedly and continuously in recognizing objects.

## Second: Applications of Artificial Intelligence in Banking Services:

1.**Applications of AI in Financial Services:** Among the potential applications of AI in the banking sector are the following (5):

**a. Anti-Money Laundering:** Anti-money laundering (AML) refers to a set of procedures, laws, or regulations designed to stop the generation of income through illegal means. Often, money laundering involves hiding the origins of money obtained through illegal activities by passing it through a complex sequence of banking transfers or commercial transactions, making it appear as though it was earned legitimately. Most major banks around the world are shifting from rule-based software systems to AI-based systems, which are more robust and intelligent in combating money laundering in the coming years. These systems are expected to become more flexible, accurate, and faster with continuous innovations and improvements in AI.

**b. Chatbots:** In customer interactions, financial institutions use chatbots to act as customer service agents. Chatbots have advanced features for effectively handling customer inquiries sent via electronic platforms. They can connect customers directly with the responsible person who can provide a suitable and quick resolution, handling their issues immediately and directly. Some banks conduct extensive tests to determine the role of chatbots in marketing to customers across various key tasks, including handling bank card theft, efficiently answering questions related to ATM locations, providing detailed information about branch hours, foreign exchange rates, and other services.

**c. Analytics:** AI-based analytics process vast amounts of data to identify behaviors, clusters, and relationships, allowing the industry to move from mere descriptive analysis to real-time prediction. Machine learning can improve processes such as risk modeling, identity recognition, fraud detection, and credit assurance.

**d. Report Generation:** Natural language processing (NLP) can convert structured data into prose, writing reports and summaries by compiling large amounts of structured data and presenting it in paragraphs that highlight key points.

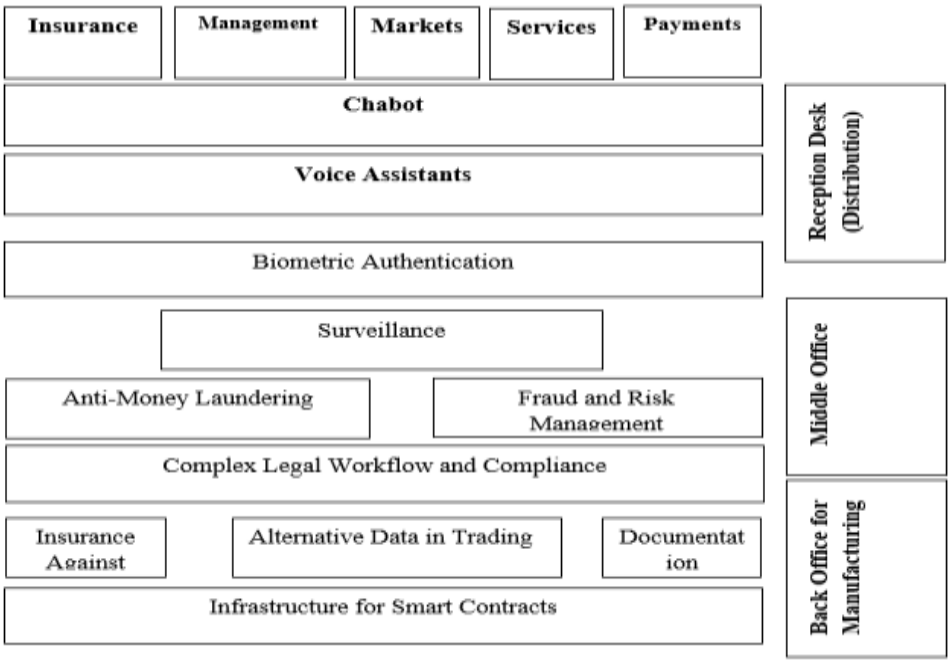
**e. Robotic Process Automation (RPA):** Several techniques are used to automatically replicate human and routine activities repeatedly and more accurately, using either paper or digital inputs. These inputs are scanned and rules are applied to them, after which the output is sent to the next step in the process.

According to Accenture, there are three ways to leverage AI:

- Ensuring a well-defined data usage strategy and its application, along with analyzing how data is used, and agreeing on the role AI tools can play in building value for employee and customer data.
- Exploring the possibility of developing an AI Center of Excellence, which can provide a central capability that can be applied across the organization. This may include external resources that can offer flexibility and speed of implementation.
- Creating a scalable environment for testing and learning, which can explore AI processes and banking operations, thereby accelerating innovation.

**2. Uses of AI Tools in Banking Services:** Financial institutions are applying AI tools across the entire value chain and all types of financial services they offer, which can be illustrated through the following figure (6):

**Figure 02:** AI Tools in Financial Services



**Source:** *Jaafari, Mohamed, Tayeb Mousli. "Artificial Intelligence in the Banking Sector and its Multiple Applications in Banking Services." Virtual International Forum: Big Data and Digital Economy as Mechanisms for Achieving Economic Takeoff in Developing Countries (Opportunities, Challenges, Prospects). Faculty of Economics, Business, and Management Sciences, University of Chahid Hamid Lakhder, El Oued, 2022, p. 04.*

In the figure, automated chatbots, voice assistants, and biometric authentication systems operate in all services provided by reception offices (distribution outlets) of financial institutions. These systems enable users to perform specific transactions (such as request transfers and account openings). Thus, communication channels with customers become automated, ensuring availability 24/7, and interaction data with users is automatically collected.
Regarding middle offices, fraud detection systems operate in payment-related services and other services, which are crucial for mitigating financial institutions' fraud risks by analyzing large volumes of data and integrating this data with new information sources to detect anomalous cases or patterns that could have otherwise gone unnoticed. Anti-money laundering systems are also used in financial markets, investment management, and insurance operations to mitigate this phenomenon in services provided by financial institutions. Middle offices utilize artificial intelligence in all their operations related to complex legal workflows and compliance, where intelligence tools facilitate compliance with specific regulatory requirements (such as risk management and reporting obligations) and monitor regulatory changes.
Back offices (manufacturing) use artificial intelligence systems in subscription processes, where increased analytical capacity improves credit assessment and speeds up loan origination processes. In both financial markets and investment management, alternative data is used in trading and management. Smart contract infrastructure is used in all transactions conducted.

### 3- The Role of Artificial Intelligence in Enhancing Banking Sector Efficiency

The use of artificial intelligence in financial and banking services reduces operational costs and improves the performance and profitability of financial institutions. Therefore, most institutions are investing in artificial intelligence applications.
According to PwC, artificial intelligence is expected to contribute approximately $7.15 trillion to the global economy by 2030, divided into $6.6 trillion from increased productivity rates and $1.9 trillion from a 2% increase in regional share. Artificial intelligence applications are expected to contribute approximately $320 billion to the economy of the Middle East by 2030, equivalent to 11% of total GDP.
Therefore, the primary role of artificial intelligence in the banking sector lies in obtaining accurate and suitable data insights with a low error rate and effectively protecting funds through anti-money laundering efforts. Artificial intelligence technologies detect patterns in incoming data that indicate money laundering, enabling early detection of fraudulent transactions that provide warnings to banks about fraudulent clients.
The advantages of artificial intelligence in the banking sector are numerous, as banks have achieved accurate and insightful data insights with low error rates through its use. Banks have also improved data quality and analyzed data more efficiently to ensure understanding of customer needs and provide equitable customer experiences (7).

### Thirdly: Towards the Adoption of Artificial Intelligence Tools in the Algerian Banking Sector

1. **Aspects of Adapting the Algerian Banking Sector to Global Transformations:** Economists believe that banks in developing countries have suffered from weaknesses due to poor management and the lack of banking competencies. Therefore, the main goal of adaptation policies should be to strengthen and enhance the financial position of banks, creating a conducive working environment to meet customer demands by providing high-quality services at affordable prices. This increases dynamism in economic activity, thereby achieving economic development through (8):

a) Improving the quality of banking services.
b) Learning customer relationship basics.
c) Updating the payment system in Algeria.
d) Increasing banking security.

2. **Recent Trends in Artificial Intelligence in the Algerian Banking Sector:** Ahmed Kesum, director of the Artificial Intelligence Laboratory at Bab Ezzouar University, presented a lecture in December highlighting the journey of artificial intelligence in Algeria and its future, making several comparisons with other countries. In this context, he mentioned that Algeria has 116 research laboratories associated with artificial intelligence. However, the output of these laboratories in terms of research remains modest but continuously growing. The country primarily needs a governmental strategy outlining national objectives, action plans, and funding over the coming years. Without such a strategy, research conducted in these labs would remain largely unproductive for the country, resembling scattered efforts incapable of accomplishing integrated projects.

Algeria also aims to benefit from its expatriate elite in innovation, artificial intelligence, and knowledge economy fields, facilitating scientific exchanges with Algerian university students (9).
The initial steps of artificial intelligence in Algeria include:

**a) Transition from user to creator: Dr**. Mustafa Awashe shifted from mere digital user and technology researcher to an innovator in projects based on artificial intelligence theory.

**b) Experimental solutions**: El Shorouk attempted to more accurately document artificial intelligence by documenting 7 new projects in Algeria that simulate machinery. Their owners provided unprecedented solutions to economic, health, education, and security sectors, with some leaving the lab and currently undergoing field trials.

**c) AI teachers enter service:** It is the first interactive educational platform in Algeria, based on non-curricular support lessons. This application aims to facilitate student learning and connect students, teachers, and parents (10).

**d) Next-generation computers are coming: The** National School of Artificial Intelligence applied for orders to acquire advanced next-generation computers, also known as high-performance computers. Basic artificial intelligence principles cannot be taught using outdated information technology.

**e) Digital Legislation:** The current situation necessitates the introduction of special legislation to frame all digital sector investment operations, where artificial intelligence tops the list.

**f) Cybersecurity... The Biggest Challenge:** The issue of cybersecurity receives greater attention from developers of artificial intelligence theory in Algeria to ensure data security and protect Algerian data, which is a top priority (11).

**g) Strategic Importance of Artificial Intelligence Application in the Algerian Banking Sector:** We can identify the strategic importance of applying artificial intelligence in the Algerian banking sector as follows:

**h)** The application of artificial intelligence in Algeria achieves significant business values.

**i)** Algerian banks can obtain accurate and suitable data insights with a low error rate using artificial intelligence.

**j)** Algerian financial institutions use artificial intelligence to reduce costs and generate new opportunities.

**k)** The use of artificial intelligence reduces fraud risks and combats money laundering faced by Algerian financial institutions.

**l)** The rapid growth of the artificial intelligence sector significantly contributes to the widespread adoption of smart services in the Algerian financial services sector.

## Conclusion

In conclusion, Algeria possesses artificial intelligence laboratories without production. Despite having frameworks and capabilities capable of success, Algeria lacks a strong technological infrastructure to aid in the development of its banking sector, combat corruption, and money laundering. Adopting a smart strategy that emphasizes effective planning and implementation is essential. This includes moving away from oil-based economies, investing in technology, relying on the digitization of administrative sectors, abandoning traditional services to gain customer satisfaction, reducing costs, minimizing errors and losses.
Moreover, adopting artificial intelligence has become a pressing necessity that Algeria must commit to in order to enhance the efficiency of its banking sector. This can be achieved through the adoption of a smart regulatory strategy with effective implementation, which helps build strong relationships with customers and enhances their trust. This is due to the safeguarding of their data and privacy, providing them with rapid service through electronic fund transfers, saving time, and adapting to changes, thereby eliminating fraud, cheating, and money laundering.
Despite these efforts, Algeria has not gained prominence or made significant progress due to societal awareness and acceptance of such advancements. The deficiencies plaguing the communication and media infrastructure must be addressed, urging Algeria to aspire to the experiences of countries that have proven successful in this field.

## Recommendations

- Government leadership in adopting artificial intelligence technologies in delivering government services to increase their efficiency levels, reduce costs, and enhance demand for such applications.
- More efforts to increase the availability and quality of data to develop artificial intelligence technologies within national frameworks that ensure privacy, data security, and protection.
- Encouraging banks to keep pace with artificial intelligence, and the transformation of financial sectors from traditional economy to digital economy while containing the risks and implications of this transformation.
- Increasing expenditure on artificial intelligence to improve banking services provided to customers, especially through various electronic technologies.
- Improving the infrastructure for information technology and communication to keep pace with current digitization.

- Developing training programs for human resources, especially regarding artificial intelligence applications and how to benefit from them.

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