

The Role of Modern Technology and Artificial Intelligence in Improving the Performance of Algerian Commercial Banks: A Case Study of Tiaret

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ABSTRACT

This study examines the extent to which modern technology and artificial intelligence contribute to improving the financial performance of Algerian commercial banks, focusing on Tiaret Province. Using a quantitative approach, a field questionnaire was administered to 108 randomly selected bank employees. Data were analysed via Stata 19.2E, applying validity and reliability tests, trend and correlation analyses, as well as multiple linear and logistic regressions. Results indicate that technology and artificial intelligence enhance banking service quality by reducing errors, accelerating transactions, and limiting paper-based processes. They also improve risk analysis and predictive capabilities, boosting financial stability and competitiveness, particularly among younger clients. Despite uneven adoption and operational challenges, Algerian banks are progressing toward actual digital transformation. The study recommends broader AI integration, staff training, and investment in digital infrastructure to strengthen financial performance and market positioning.

Keywords: Banking performance, modern technology, artificial intelligence, Algerian commercial banks.

JEL Classification Codes: G21, L86, O33, C83

1. INTRODUCTION

Modern technology and AI have been a key driver for the transformation of economic sectors, most notably banking, toward more efficient, effective, and competitive business models. In the midst of banks' race towards digital transformation, maintaining technological leadership becomes an imperative necessity to keep pace with global acceleration. AI, in particular, has reshaped the working mechanisms of banks, prompting many of them to adopt it as a strategic option to meet the demands of the ever-changing

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environment. At the Algerian level, commercial banks have begun adopting modern technology in an effort to improve the quality of services and enhance their competitiveness. This approach faces a number of challenges, most notably infrastructure constraints, a lack of specialized human resources, and traditional management styles. However, growing awareness of the importance of technology and AI as catalysts for banking performance shows a serious will to move to more modern and efficient digital systems or models.

1.1. Problem Statement

In light of the above, the main problem raised in the research is: How does the use of modern technology and AI affect performance in Algerian banks?

1.2. Study Objectives

Our discussion of this topic aims to achieve a number of objectives, the most prominent of which are:

- 1.2.1.* Contributing to enriching the theoretical and applied aspect of knowledge about the role of modern technology and AI in the banking field;
- 1.2.2.* Analysis of the nature of electronic banking services and the approved electronic payment systems and means;
- 1.2.3.* Evaluating the extent to which modern technology and AI contribute to improving banking performance and raising its efficiency.

1.3. Study Hypotheses

To answer the main problem, the following hypotheses are put forward:

- 1.3.1.* Modern technology has a positive and direct impact on improving banks' performance;
- 1.3.2.* The adoption of AI contributes to raising the efficiency of banking services and improving their quality;
- 1.3.3.* There is a direct relationship between the degree of adoption of these technologies and the improvement of banking performance indicators.

1.4. Study Methodology

The current study adopts a descriptive approach to present and explain the theoretical framework of the research variables. An analytical approach is also employed to analyze and accurately interpret the results. In the applied component, a quantitative approach is used by collecting field data through a questionnaire administered to a random sample of 108 employees to examine the nature of the relationship between the study variables. The data are analyzed statistically using Stata 19.2E, applying advanced statistical techniques, including validity and reliability tests, trend analysis, correlation analysis, as well as multiple linear

regression and logistic regression, in order to ensure the accuracy and objectivity of the results.

2. FOUNDATIONS OF BANK PERFORMANCE

Bank performance is regarded as a key indicator that reflects the efficiency and effectiveness of banking institutions in achieving their financial and service objectives. Accordingly, its definition, types, and components are outlined in the sections that follow:

2.1. Definition of Bank Performance

Bank performance is defined as “the set of necessary means, diverse activities, and efforts undertaken to enable banks to fulfill their roles and execute their functions within the surrounding external banking environment, in order to provide banking services” (Al-Rubaie, 2011, p. 145). This broad conceptualization is complemented by a more operational perspective, where it is used to denote, “the adoption of a set of financial and non-financial indicators that illustrate the current position of a banking institution and its capacity to achieve the prominent and intended objectives”. Finally, the practical dimension of bank performance is reflected in its measurement, as it represents “the process through which the outcomes achieved by banking institutions over a specific period are measured”. (Sanad Yani, 2024, p. 96)

2.2. Types of Bank Performance

Bank performance can be classified into the following types: (Makhoukh, 2022, pp. 335-336)

2.2.1. Financial Performance

Financial performance determines the extent to which a banking institution is able to optimally utilize all available resources to achieve its established and planned objectives;

2.2.2. Commercial Performance

Commercial performance reflects the efficiency and effectiveness of the bank's commercial and marketing functions in achieving sales targets and customer satisfaction. Key indicators of commercial performance include profitability, revenue, number of clients, purchase frequency, and the range of products and services offered by the bank;

2.2.3. Functional Performance

Functional performance indicates how effectively an individual fulfills the requirements of their role. While effort and performance are often interrelated, effort refers to the energy expended, whereas performance is measured based on the outcomes achieved;

2.2.4. Strategic Performance

Strategic performance represents the degree to which the bank's strategy is effectively communicated and understood throughout all levels of the organizational structure, from top management to operational staff; and

2.2.5. Marketing Performance

Marketing performance measures the bank's ability to achieve the objectives of its marketing function with maximum efficiency and effectiveness, by increasing sales, expanding market share, and enhancing customer satisfaction.

2.3. Components of Banking Performance

Banking performance can be understood through several key components, each reflecting a distinct aspect of organizational success. First, *Efficiency* refers to the ability to optimize the use of available resources by employing them appropriately according to specific criteria related to quality and cost. It reflects the relationship between the resources utilized and the results achieved, highlighting the extent of inputs required to reach a given level of outputs or achieve specified goals, i.e., maximizing benefit relative to cost. Closely related to efficiency is *Effectiveness*, which captures the organization's capacity to achieve its objectives by enhancing the performance of necessary activities. Effectiveness measures the degree to which employees perform the tasks required to attain organizational goals without engaging in unnecessary actions. It can also be defined as the organization's ability to deploy its resources efficiently to accomplish specific targets, indicating the extent to which these goals are successfully realized.

3. THE REALITY OF APPLYING MODERN TECHNOLOGY AND AI IN ALGERIAN COMMERCIAL BANKS

3.1. The Reality of Applying Modern Technology in Algerian Commercial Banks

In light of rapid technological developments, commercial banks are required to update their systems and improve the quality of their services to keep pace with changing market requirements. In Algeria, some banks have begun to adopt modern technology to varying degrees, relying on multiple digital tools, but these efforts still face a set of challenges that limit the possibility of generalizing technological applications and achieving the desired effectiveness.

3.1.1. The Extent of Application of Modern Technology in Algerian Commercial Banks

With the acceleration of technological developments in the banking sector around the world, it has become imperative for Algeria to embrace digital banking services to enhance its competitiveness and keep pace with these transformations. However, the reality indicates that most Algerian financial institutions still lag behind in this field. This is due to the weakness of the technical infrastructure and the lack of expertise in managing advanced digital systems, which has led to a slow delivery of banking services and a decline in their efficiency. (Barkat, 2021, p. 193)

The Algerian banking system occupies a narrow position in the field of interest in modern trends in banking services, due to the noticeable delay in the technological field, although it has made efforts to develop its banking system, through the amendments and reforms it has made for more than 10 years. Algeria has begun, within the framework of comprehensive economic reforms, to reform its banking system, in preparation for the transition towards a market economy and in preparation for integration into the global economy. In this field, many legislations were issued, most notably the 1986 reforms in its banking system, what was stated in the Monetary and Loan Law 90/10, and the developments it achieved to adopt a market economy and open the field of competition, and the resulting liberalization of financial banking services, as it relied on traditional payment systems, most of which were not characterized by the required effectiveness, which forced it to adopt modern means and systems with international standards. The beginning of the introduction of the Internet into business and the emergence of the phenomenon of e-commerce, which led to the emergence of an e-economy based on modern technology.

Within the framework of banking modernization reforms, the Bank of Algeria, in cooperation with commercial banks and the Ministry of Finance, and with the support of the World Bank, launched a group of modern technological projects and systems, the most prominent of which are: the SWIFT system (SWIFT), which is a global network for exchanging financial information from banks, the instant settlement system, Electronic clearing system: The adoption of these systems has contributed to the introduction of new digital banking services such as bank cards and electronic payment devices, and this has helped improve the speed of transactions and reduce costs, in addition to enhancing security, which has had a positive impact on the national economy.

3.1.2. Tools for Applying Modern Technology in Algerian Commercial Banks

In the context of digital transformation and keeping pace with technological developments in the banking sector, Algerian commercial banks have sought to adopt modern tools that have contributed to modernizing their systems and services. Below, the most prominent tools that have enabled banks to apply modern technology, are discussed:

3.1.2.1. Immediate Total Payment System for Large Amounts and Urgent Payments (ARTS). This system is the system in which total amounts are settled in real time, as transfers are implemented continuously, immediately, without postponement, and on an aggregate basis, and the aggregate settlement means every transaction that is carried out in the Bank of Algeria on an aggregate basis after ensuring Sufficient balance is available, while immediate settlement indicates the continuity of operations without interruption or postponement. (Barkat, 2021, p. 194) The System was adopted pursuant to System No. 05/04 issued on October 13, 2005, and entered into force in February 2006, as a tool for modernizing payment systems, in response to the principles

recommended by the Payment and Settlement Systems Committee of the Bank for International Settlements, while ensuring transparency in the implementation of operations;

3.1.2.2. Electronic Payments Clearing System (ATCI). It is an extension of the ARTS system, which specializes in the automated processing of public payment methods, which include transfer certificates, deductions, withdrawals and payments using bank cards, using advanced technologies such as software. This system was adopted on May 15, 2006 as the second part of advanced payment systems, in accordance with international standards, with the aim of improving the quality of services provided to customers. This system entered into force with the participation of the Bank of Algeria and all commercial banks and financial institutions, in addition to Algeria Telecom and Algeria Post at the level of all branches and offices spread across the national territory, and its operation depends on the information exchange of digital and accounting data; (Barkat, 2021, p. 195)

3.1.2.3. Automated Teller Machine (ATMs). ATMs are available in Algerian banks and are divided into: (Banqueswiki, 2025)

3.1.2.3.1. Automated Bank Dispensers (DAB). These are automatic devices mainly intended for distributing banknotes, i.e. for withdrawing cash from bank accounts. It allows customers to make transactions such as cash withdrawals and view the balance without having to go to a bank branch;

3.1.2.3.2. Automated Banking Windows (GAB). It is a broader automated banking branch than DAB, as it provides additional banking services in addition to cash withdrawals, such as requesting a checkbook, submitting a check for collection, viewing the account statement, making money transfers between accounts, and performing operations on the electronic savings book. It also provides interactive services via tablets equipped with video technology to simulate loan, financing and insurance applications, and direct contact with bank representatives. By September 2023, the number of these distributors in Algeria reached approximately 3786, spread across the country, and approximately 15171133 automated withdrawals had been recorded. (Rafine, 2024, p. 547)

3.1.2.4. Mobile banking. Some banks in Algeria offer mobile banking services, which require a mobile phone, computer, or internet connection to connect the customer to their bank. This service is limited to checking account balances, making transfers between agencies of the same bank, and paying telephone bills; (Djellailia & Ben Abdel Fattah, 2019, p. 153)

3.1.2.5. Electronic check. It is one of the most prominent electronic payment methods spread in Algeria, as it is organized and processed through the ATCI system via electronic clearing. Banks, the public treasury, and the Algerian Post rely on scanner devices dedicated to passing checks on them. These devices store information related to the check, such as the customer's identity, the beneficiary's identity, the account number of the sending bank, the amount mentioned on the check, and other data written on both sides of the check. This data is then sent and exchanged between the parties involved in electronic clearing; (Djellailia & Ben Abdel Fattah, 2019, p. 154)

3.1.2.6. Bank cards. The banking industry in Algeria has made significant progress in issuing bank cards, especially with the establishment of SATIM. In 1996, this company was founded through a banking group that includes BADR, BDL, BEA, BNA, CPA, CNMA, ALBARAKA and CETP. The tasks of this company include modernizing banking technologies, regulating the movement of cash between banks, modernizing payment methods, and enhancing electronic processing between banks. Most banks offer their customers the CIB card, which is an interbank payment and withdrawal card within the national territory, identified by banks by the CIB logo and the name of the issuing bank. The card contains an electronic loan to ensure the security of payment and repayment operations. (Ait Chaalal, 2019, p. 12)

3.2. The Reality of Applying AI in Algerian Commercial Banks

The rapid development of AI technology has revolutionized financial services, reshaping educational systems and opening new horizons for greater financial inclusion, innovation, and increased efficiency. Despite this global development, the use of AI in the Algerian banking sector is still in its early stages and faces a number of challenges. Nevertheless, Algeria has begun to take concrete steps toward modernizing its financial architecture. (Amrane & Damen, 2023, p. 214)

3.2.1. The Algerian Commercial Banking Sector in light of Developments in AI

The AI market is expected to be worth \$19061 billion, with an estimated contribution of 5 per cent to global GDP. Equivalent to approximately \$13 trillion in the future, and to benefit from this advantage and join the national global programs for AI, the Minister of Higher Education and Scientific Research launched the Algerian Strategic Plan for AI, during December 1 and 2, 2019 in the city of Constantine. This national initiative calls for developing local capabilities in the fields of training, education and scientific research, considering that AI represents a strong lever for economic development. It provides effective tools to overcome obstacles hindering digital transformation in various sectors;

3.2.2. Tools for Applying AI in Algerian Commercial Bank

Today, AI technologies represent a global technological revolution that has radically transformed many sectors. They enable computers and machines to mimic human capabilities to learn, understand, solve problems, and make decisions independently. This has led to the development of intelligent applications capable of analyzing big data, interacting with users, and predicting outcomes with high accuracy in the global banking sector. In the Algerian context, commercial banks have begun to realize the importance of exploring and adopting AI technologies to keep pace with the requirements of the digital age and modern economic challenges. This requirement aims to present the most prominent tools for applying AI in Algerian commercial banks:

3.2.2.1. Electronic Bank. The electronic bank provides a set of distinguished services that aim to improve communication with customers and enhance their knowledge of the bank and its services. Among the most important of these services are:

3.2.2.1.1. Email Service. This service provides customers in Algerian banks with the ability to send their inquiries, suggestions, complaints and opinions about the bank's various services, via an email address designated for this purpose. The bank also provides phone numbers for direct communication, with the aim of following up on customers' needs and better understanding their aspirations;

3.2.2.1.2. Publishing Service. Through this service, the bank displays its latest news and events in which it participates, in addition to articles published about it in specialized newspapers and magazines. This service contributes to enhancing the bank's image and informing the public of its activities;

3.2.2.1.3. Network banking service. This service allows customers to access comprehensive information about the bank's various agencies and branches, including ways to contact them. Agencies are classified according to regional research directorates.

3.2.2.2. Wimpay, the scanning payment service (Wimpay): "Wimpay" is a mobile payment service integrated into the DZ Mobpay network, enabling users to conduct financial transactions quickly, easily, and securely through a smartphone. By utilizing QR code technology and advanced encryption mechanisms, the service allows customers to make in-store payments, transfer funds between individuals, and manage their daily financial operations quickly, efficiently, and safely; (BDL, 2024; CPA, 2025)

3.2.2.3. Chatbot: Since their initial adoption by a banking application in 2015, chatbot services have undergone significant development. Advances in AI, natural

language processing (NLP), and emerging communication channels such as Google Home, Alexa, and social media platforms have led to their widespread integration across most banks and financial institutions. These services efficiently manage a wide range of repetitive tasks while maintaining high accuracy. Furthermore, chatbots can be customized to meet individual customer needs. They may operate in text-based or voice-based formats and are accessible via mobile applications, banking websites, social media messaging platforms, or voice-activated personal digital assistants (Whats Loop, 2026). The banking chatbot on Messenger offers an interactive platform for accessing banking information and performing tasks efficiently. The Bank Agency Definition Service provides branch details via a Gallery, while the Bank Agency Services Overview presents a structured menu of available services. The *FAQs service* delivers AI-powered, 24/7 answers to common queries, organized through the Gallery for easy navigation. The Electronic Banking Reference Service (“*Ask the Bank*”) acts as a digital advisor, offering personalized responses to text queries and scheduled requests. Together, these AI-driven services enhance accessibility, speed, and accuracy, improving customer engagement with banking through Messenger. (Seffehlou & Madi, 2024, pp. 200-203)

4. STUDY METHODOLOGY

The next section presents the study methodology and explains the procedures adopted to address the research objectives.

4.1. Research Design

The present study investigates the role of modern technology and AI in enhancing the performance of Algerian commercial banks. Data were collected through a field survey of banking agencies in Tiaret using a structured questionnaire, enabling a detailed analysis of the adoption of these technologies and their impact on banking service performance. The study employs a quantitative, descriptive and analytical design to systematically measure participants' perceptions and examine the relationships between the variables.

4.2. Population and Sample

The study population comprises employees of commercial banks operating in the state of Tiaret. A random sampling method was employed to ensure representation across different job levels and departments. A total of 108 participants completed the questionnaire. This sample size is considered adequate for conducting correlation and regression analyses while maintaining sufficient statistical significance.

4.3. Data Collection Instrument

Data were collected using a structured electronic questionnaire specifically designed for this study. The instrument aimed to measure three key constructs: modern technology adoption, AI implementation, and financial performance of banking services. It comprised closed-ended items rated on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). In addition, the questionnaire included demographic questions on gender, age, education level, and employment position to provide context for the analysis. This instrument represents a suitable quantitative tool for assessing the level of digital transformation in the banking sector.

4.4. Dimensions of the Questionnaire

The questionnaire is designed to assess the impact of modern technology and AI on the banking sector across three principal dimensions:

4.4.1. The First Dimension: Modern Technology

It contained six phrases that measure the extent of the bank's use of electronic systems, digital channels, automated devices, and the impact of technical awareness;

4.4.2. The Second Dimension: AI

It included six phrases focusing on its role in new services, security, automation, decision improvement, and its impact on jobs;

4.4.3. The Third Dimension: Financial Performance

Five included statements distributed into two sections, measuring performance improvement, cost reduction, profit increase, marketing enhancement, and risk assessment.

4.5. Validity and Reliability

This section reports the results of the validity and reliability analysis for the study measures, using Cronbach's alpha to assess internal consistency. The analysis evaluates the degree of consistency among the items within each of the three research dimensions—modern technology, AI, and financial performance—to determine the reliability of the measurement instruments and their suitability for subsequent statistical analyses. The results are summarized in the table below:

Table 1. Validity Test

Dimension	Item	Obs.	Item-Test Correlation	Item-Rest Correlation	Alpha if Item Deleted
Modern Technology	tech01	108	0.5452	0.2994	0.6122
	tech02	108	0.6705	0.4585	0.5493
	tech03	108	0.5531	0.2960	0.6149
	tech04	108	0.5574	0.3301	0.6002
	tech05	108	0.7263	0.5456	0.5147

	tech06	108	0.5066	0.2605	0.6255
Overall Alpha	-	-	-	-	0.6318
Artificial Intelligence	ai01	108	0.7150	0.5557	0.6364
	ai02	108	0.6286	0.4297	0.6743
	ai03	108	0.6811	0.4840	0.6568
	ai04	108	0.5566	0.3361	0.7025
	ai05	108	0.6450	0.4405	0.6711
	ai06	108	0.6087	0.4103	0.6801
Overall Alpha	-	-	-	-	0.7098
Financial Performance	fin01	108	0.6045	0.3637	0.5846
	fin02	108	0.5786	0.2969	0.6184
	fin03	108	0.6360	0.3948	0.5695
	fin04	108	0.6694	0.4247	0.5535
	fin05	108	0.6836	0.4352	0.5473
Overall Alpha	-	-	-	-	0.6290

Source : Compiled by the researchers using Stata 19.2E

The psychometric analysis of the measurement scales used in this study provides clear indicators of their internal consistency. Cronbach's alpha reached 0.6318 for the modern technology scale, 0.7098 for the AI scale, and 0.6290 for the financial performance scale. These values are considered acceptable in exploratory research contexts. Moreover, the positive item–total correlations, despite some variation in magnitude, indicate that all items contribute to measuring the intended constructs. The AI scale demonstrates relatively higher internal consistency. In addition, the deletion of certain items, such as fin02 from the financial performance scale, may lead to a slight improvement in reliability. Overall, the results confirm the adequacy and suitability of the measurement instruments for use in the current study. Although the Cronbach's alpha values are acceptable for exploratory research, the coefficients for the modern technology (0.6318) and financial performance (0.6290) dimensions remain close to the minimum threshold. This suggests that, while being adequate, there is room for further improving the internal consistency of these scales in future studies. Accordingly, future research should aim to enhance measurement reliability by refining and clarifying questionnaire items, increasing the number of indicators, and conducting pilot studies to better capture the constructs under investigation.

4.6. Data Collection Procedure

The questionnaire was administered electronically and distributed to participants via email and secure online links, allowing respondents to complete it at their convenience

during work hours. All participants provided informed consent and were assured of confidentiality and anonymity, in accordance with ethical research standards.

4.7. Data Analysis

Collected data were analysed using Stata 19.2E. Descriptive statistics, including means and standard deviations, were first computed to summarize the responses. To examine the relationships between the study variables, the Pearson correlation test was employed. Subsequently, multiple regression analysis was conducted to assess the impact of both modern technology and AI on the financial performance of banks. normality tests were performed prior to hypothesis testing to ensure the appropriateness of parametric analyses.

4.7.1. Description of the Study Variables

Table 2. Summary and Description of the Study Variables

Demographic variable	Category	Frequency	Percent
Gender	Male	63	58.33
	Female	45	41.67
	Total	108	100.00
Age-group	20 - 30 years	20	18.52
	31 - 40 years	39	36.11
	41 - 50 years	35	32.41
	51 - 60 years	14	12.96
	Total	108	100.00
Education	Secondary	24	22.22
	University	52	48.15
	Postgraduate	32	29.63
	Total	108	100.00
Job-level	Executive Assistant	68	62.96
	Head of Department	30	27.78
	Vice Director	10	9.26
	Total	108	100.00

Source : Compiled by the researchers using Stata 19.2E

The table above indicates that the study sample consists of 108 participants, with a male majority representing 58.33 per cent, compared to 41.67 per cent females. Regarding age distribution, the 31–40 years category ranks first at 36.11 per cent, followed by the 41–

50 years group at 32.41 per cent, reflecting the predominance of professionally active age groups within the sample. In terms of educational attainment, the data reveal a relatively high academic qualification level: 48.15 per cent of participants hold a university degree, while 29.63 per cent possess postgraduate qualifications. When it comes to job position, the sample is predominantly operational in nature, with 62.96 per cent of respondents occupying executive staff positions, whereas the remaining proportion is distributed across supervisory and managerial roles.

4.7.2. Analysis of the Study Dimensions' Trends

number	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Standard Deviation	Rank
01	22 20.37%	27 25.00%	41 37.96%	15 13.89%	3 2.78%	3.46	1.05	3
02	13 12.04%	32 29.63%	46 42.59%	11 10.19%	6 5.56%	3.32	1.00	4
03	19 17.59%	41 37.96%	37 34.26%	11 10.19%	0 0.00%	3.63	0.89	2
04	15 13.89%	26 24.07%	40 37.04%	19 17.59%	8 7.41%	3.19	1.11	5
05	13 12.04%	21 19.44%	34 31.48%	29 26.85%	11 10.19%	2.96	1.17	6
06	15 13.89%	50 46.30%	34 31.48%	9 8.33%	0 0.00%	3.66	0.82	1

Based on the analysis of the responses of the 108 participants to the modern technology dimension, three principal trends emerge.

First, the findings reveal a clear consensus regarding the bank's adoption of advanced technologies. The statement related to the use of digital technologies such as AI and blockchain (Item 06) recorded the highest mean score (3.66) with a relatively low standard deviation (0.82). The combined proportion of respondents who strongly agreed and agreed reached 60.19 per cent, compared to only 8.33 per cent who expressed disagreement. This reflects a positive perception of the institution's technological infrastructure.

Second, some items showed more moderate levels of agreement accompanied by higher neutrality rates. For instance, the statement concerning the bank's reliance on electronic systems for transactions (Item 01) obtained a mean of 3.46 with a relatively higher standard deviation (1.05). The highest proportion of neutral responses (37.96 per cent) suggests that such systems may be perceived as standard operational requirements rather than distinctive competitive advantages.

Third, the results highlight a notable cultural and behavioral challenge. The statement addressing the impact of limited digital awareness among customers (Item 05) recorded the

lowest mean (2.96) and the highest standard deviation (1.17). While 31.48 per cent agreed that this issue exists, 37.04 per cent disagreed, indicating substantial divergence in perceptions. This variability underscores a potential gap between the institution's technological advancement and customers' readiness to fully engage with digital services. Consequently, the findings suggest the need for targeted awareness and education strategies to maximize the benefits of advanced technological investments.

Table 4. Analysis of Trends in the AI Indicator

Number	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Standard Deviation	Rank
01	18 16.67%	35 32.41%	38 35.19%	14 12.96%	3 2.78%	3.47	1.02	4
02	20 18.52%	42 38.89%	32 29.63%	11 10.19%	3 2.78%	3.60	0.98	2
03	16 14.81%	39 36.11%	40 37.04%	10 9.26%	3 2.78%	3.51	0.93	3
04	22 20.37%	44 40.74%	30 27.78%	10 9.26%	2 1.85%	3.69	0.94	1
05	14 12.96%	36 33.33%	42 38.89%	13 12.04%	3 2.78%	3.42	0.95	5
06	12 11.11%	18 16.67%	35 32.41%	31 28.70%	12 11.11%	2.88	1.18	6

Source : Compiled by the researchers using Stata 19.2E

The results of the AI dimension, based on a sample of 108 respondents, reveal a clear gradation in the levels of acceptance toward the proposed statements. Initially, Item 04 recorded the highest mean score (3.69) with a relatively low standard deviation (0.94). The combined proportion of respondents who strongly agreed and agreed reached 61.11 per cent, while total disagreement did not exceed 11.11 per cent, indicating a notable consensus and a highly positive evaluation of this specific statement. Next, item 02 ranked second, with a mean of 3.60 and an overall agreement rate of 57.41 per cent, further reinforcing the general pattern of acceptance. Then, a moderate evaluation emerged for three statements: Item 03 (mean = 3.51), Item 01 (mean = 3.47), and Item 05 (mean = 3.42). This group was characterized by relatively high neutrality rates, peaking at 38.89 per cent for Item 05. Such a distribution suggests a degree of reservation or hesitation among a considerable segment of respondents, although the arithmetic means still lean toward a positive orientation. In contrast, Item 06 stands out as a clear exception. It recorded the lowest mean score (2.88) and the highest standard deviation (1.18), reflecting substantial dispersion and heterogeneity in respondents' opinions. The total disagreement rate (disagree and strongly disagree) reached 39.81 per cent, compared to a relatively weak overall agreement rate of 27.78 per cent, with 32.41 per cent remaining neutral. This distribution confirms the presence of

relatively strong and uneven rejection toward the content of the sixth statement, in contrast to the generally positive trend observed across the remaining items. This divergence may be explained by the limited implementation of advanced AI applications in Algerian banks, leading to uneven exposure among employees. It may also reflect differences in awareness and understanding of AI concepts, as well as the early stage of AI adoption where practices are not yet standardized across institutions.

Table 5. Analysis of Trends in the Financial Performance Indicator

Number	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	Standard Deviation	Rank
01	24 22.22%	41 37.96%	32 29.63%	9 8.33%	2 1.85%	3.71	0.94	2
02	18 16.67%	39 36.11%	38 35.19%	11 10.19%	2 1.85%	3.56	0.94	5
03	20 18.52%	40 37.04%	36 33.33%	10 9.26%	2 1.85%	3.61	0.93	3
04	22 20.37%	44 40.74%	32 29.63%	8 7.41%	2 1.85%	3.72	0.92	1
05	19 17.59%	42 38.89%	35 32.41%	10 9.26%	2 1.85%	3.61	0.93	4

Source : Compiled by the researchers using Stata 19.2E

The results of the financial performance dimension reflect a largely homogeneous and positive pattern. First, all five statements recorded relatively high mean scores exceeding the threshold of 3.5, with only slight variation among them. Item 04 ranked first with the highest mean (3.72), followed closely by Item 01 (mean = 3.71). The overall agreement rates (strongly agree and agree) for these two items reached 61.11 per cent and 60.18 per cent, respectively, while total disagreement did not exceed 10.19 per cent in either case. This indicates a high level of consensus and satisfaction regarding the aspects measured by these statements. The remaining three statements (Items 03, 05, and 02) showed closely aligned mean scores ranging from 3.61 to 3.56. This group was characterized by a noticeable proportion of neutral responses, varying between 32.41 per cent and 35.19 per cent, while overall agreement ranged from 54.63 per cent to 56.48 per cent. These figures suggest a strong positive orientation, albeit accompanied by a certain degree of hesitation or cautious evaluation among a substantial segment of respondents. It is also noteworthy that the standard deviation values were consistently low across all items, ranging between 0.92 and 0.94. This indicates a high level of response homogeneity and relative agreement in the evaluation of each statement, with no evidence of sharp divergence in opinions. Overall, the

sample's perceptions of this dimension demonstrate a clear positive tendency, with the highest levels of acceptance and consensus cantered on Items 04 and 01.

4.7.3. Normality Test

Table 6. Normality Test for the Average Values of *mean_tech*, *mean_ai*, and *mean_fin*

Variables	Skewness	Kurtosis	Final assessment of the distribution
<i>mean_tech</i>	0.160	2.411	Accepted Normal distribution
<i>mean_ai</i>	-0.231	2.482	Accepted normal distribution
<i>mean_fin</i>	-0.170	3.015	Excellent normal distribution

Source : Compiled by the researchers using Stata 19.2E

The analysis of the distribution characteristics for the three main dimensions (modern technology, AI, and financial performance

) indicates full conformity with the normality assumption. All skewness values fall within the statistically acceptable range (± 0.5), confirming the symmetry of the data distribution and the absence of systematic bias. Additionally, the kurtosis values, which are close to the theoretical value of 3—particularly for the financial performance dimension (3.015)—reflect response homogeneity and the lack of influential outliers. These results support the use of advanced parametric tests and confirm the suitability of the data for statistical generalization, thereby enhancing the scientific credibility of the study.

5. HYPOTHESES TESTING AND DISCUSSION OF RESULTS

Before testing the study hypotheses, it is necessary to conduct a normality test for the means of the study dimensions in order to determine the most appropriate choice between parametric and non-parametric statistical tests.

5.1. Correlation Analysis

Correlation analysis represents the first methodological step in understanding the nature, direction, and strength of the relationships between the research variables. This analysis is based on calculating the correlation coefficient, which ranges from (-1) to (+1). Values near zero indicate a weak relationship, while values approaching (± 1) reflect a strong relationship. It is important to note that correlation analysis does not establish causality; rather, it reveals the degree of shared variance between variables. The results of this analysis are presented in the following table:

Table 7. Correlation Analysis Between *mean_tech*, *mean_ai*, and *mean_fin*

	<i>mean_tech</i>	<i>mean_ai</i>	<i>mean_fin</i>
<i>mean_tech</i>	1	.402626	.298611
<i>mean_ai</i>	.018627	1	.01568
<i>mean_fin</i>	-.070267	.463081	1

Source : Compiled by the researchers using Stata 19.2E

Based on the results of the Pearson correlation matrix, the dynamics of the bivariate relationships among the main research dimensions can be summarized as follows: The analysis revealed a moderate positive correlation between the modern technology dimension (*mean_tech*) and AI (*mean_ai*), with a correlation coefficient of 0.403. This indicates a clear integration between technological infrastructure and advanced intelligent applications within the studied institutions, reflecting that investment in a digital foundation facilitates the adoption of more sophisticated solutions. In contrast, the relationship between modern technology (*mean_tech*) and financial performance (*mean_fin*) was very weak and negative, with a correlation coefficient of (-0.070). This may reflect the high initial capital costs of digital transformation before financial returns are realized over the medium or long term, or it may suggest that the financial impact of technology depends on other mediating factors. The correlation between AI and financial performance was the weakest, at 0.016, confirming that mere technological adoption does not necessarily guarantee improved financial outcomes. Achieving financial value from AI requires accompanying organizational and managerial enabling factors. Collectively, these results provide important insights for practitioners: while investment in technology and AI is interrelated and complementary, their direct linkage to financial performance remains unclear in bivariate analysis. This highlights the need for more complex analytical models that incorporate mediating and moderating variables to fully understand the pathways through which digital transformation creates financial value.

5.2. Testing the Effect of Modern Technology and AI on Banks' Financial Performance

This analysis presents the results of testing the hypothesis regarding the impact of modern technology and AI on banks' financial performance using a multiple logistic regression model. The model examines the ability of these two independent variables to predict the probability of financial performance being classified into multiple categories, while controlling for demographic and professional factors. This approach provides a

probabilistic perspective on the complex relationships between digital transformation and financial outcomes.

Table 8. Multiple Regression Analysis of the Effect of *mean_tech* and *mean_ai* on *mean_fin*

<i>mean_fin</i>	Coefficient	Std. err.	t P>t	Beta
<i>mean_tech</i>	-.1774618	.1032766	-1.72 0.089	-.1654732
<i>mean_ai</i>	.06358	.1199223	0.53 0.597	.0510558
<i>_cons</i>	3.279873	.4645554	7.06 0.000	.

Source : Compiled by the researchers using Stata 19.2E

The results of the multiple linear regression analysis indicate that the estimated regression equation for the model is as follows:

$$\text{mean_fin} = 3.280 - 0.177 \times \text{mean_tech} + 0.064 \times \text{mean_ai}$$

The multiple linear regression model is statistically significant as a whole ($F(2, 105) = 1.57$, $\text{Prob} > F = 0.0124$), indicating that the two independent variables together explain a statistically meaningful portion of the variance in *mean_fin*. However, the low R-squared value (0.0291, i.e., 2.91 per cent) and adjusted R-squared (0.0106) suggest that the model has limited explanatory power, accounting for only a small fraction of the variance, while the majority remains unexplained by the included factors. This indicates that financial performance in Algerian commercial banks is influenced by several other factors beyond modern technology and artificial intelligence including monetary and regulatory policies imposed by the Bank of Algeria, the level of market competition, macroeconomic conditions such as inflation and economic growth, as well as internal managerial efficiency and risk management practices. In addition, the effects of digital transformation often appear over the medium and long term, as technological investments require time before generating measurable financial returns. Regarding individual effects, *mean_tech* exhibits a marginally negative effect ($p = 0.089$), implying that higher levels of technology are associated with a slight decrease in financial performance. Conversely, *mean_ai* lacks statistically significant evidence of a positive effect ($p = 0.597$). These results indicate that while the model is significant overall, the direct impact of modern technology and AI on financial performance remains weak within this framework, and may depend on complementary organizational and economic conditions

Table 9. Univariate Regression Analysis of *mean_tech* and *mean_ai* on *mean_fin*

Source	SS	df	MS	F	Prob > F
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Model	1.44092314	2	0.72046157	1.57	0.0124
Residual	48.1087064	105	0.458178156		
Total	49.5496296	107	0.46308065		

Source : Compiled by the researchers using Stata 19.2E

The analysis of variance table shows that the total variance of the dependent variable (*mean_fin*) is 49.5496. The model contributes only 1.4409, which is about 2.9 per cent of the total variance, which is consistent with the low *R – squared* value. The remaining variance remains at 48.1087, reflecting that the largest part of the variance (about 97.1 per cent) is not explained by the two current independent variables. A test value of F (1.57) with a probability (Prob > F = 0.0124) less than 0.05 confirms the statistical significance of the model as a whole at a significance level of 5 per cent.

5.3. Logistic Regression Analysis

Amid increasing investments in digital transformation within the banking sector, a critical issue arises regarding the extent to which these investments translate into tangible improvements in financial performance. This study aims to examine the relationship between the level of adoption of modern technology and AI and the probability of classifying institutions into different financial performance categories. A multiple logistic regression analysis is employed to assess this complex relationship, allowing for a probabilistic evaluation of how digital adoption influences financial outcomes. The results are presented in the following table:

Table 10. Results of the Multiple Logistic Regression Examining the Effect of Modern Technology and AI on Financial Performance classification (categories: low, medium, high)

perf_categ~2	RRR Std. err.	z	P>z	[95% conf.	interval]
Low Performance					
<i>mean_tech</i>	2.486587 1.048042	2.16	0.031	1.088531	5.680237
<i>mean_ai</i>	.6691501 .3224905	-0.83	0.405	.2601927	1.720885
<i>_cons</i>	.0671277 .1264542	-1.43	0.152	.0016727	2.69391
Medium Performance	(base outcome)				
High Performance					
<i>mean_tech</i>	1.086137 .4369652	0.21	0.837	.4936697	2.389641
<i>mean_ai</i>	.7623468	-0.60	0.549	.3140513	1.850566

	.3449469				
_cons	.6032156	-0.29	0.771	.0202002	18.01314
	1.045362				

Source : Compiled by the researchers using Stata 19.2E

The multiple logistic regression analysis reveals complex results that challenge traditional theoretical expectations. The weak statistical significance indicates the limited explanatory power of the model, with a Pseudo R-squared of only 0.028. Moreover, the model as a whole did not reach statistical significance ($\text{Prob} > \chi^2 = 0.214$). At the level of category-specific comparisons, the results show a notable contradiction. Modern technology (*mean_tech*) does not exhibit a statistically significant effect on the probability of being classified in the high-performance category relative to the reference (medium) category, with an odds ratio of 1.086 and a probability of 0.837. However, it is significantly associated with an increased likelihood of classification in the low-performance category, with an odds ratio of 2.487 and a probability of 0.031. This indicates that a one-unit increase in the level of modern technology nearly doubles and a half the odds of being classified as low-performing. In contrast, AI (*mean_ai*) does not demonstrate a statistically significant effect in either comparison, as the probabilities in both cases exceed 0.405.

The presented results explain the paradox through several possible mechanisms. They may reflect the high initial investment costs in technological infrastructure before the maturity stage of financial returns, or indicate a gap in the organizational competencies necessary to achieve optimal utilization of these technologies, or suggest the existence of a long-term transition period separating the process of technical adoption from the emergence of its tangible effects on performance. These results highlight the need for more complex research models. It goes beyond examining the direct relationship between technology and performance, to focus on the intermediate and controlling variables that determine the conditions under which economic value is achieved from digital investments.

6. CONCLUSION

The study reached a set of results that reflect the complex relationship between modern technology, artificial intelligence, and financial performance in Algerian commercial banks. The findings revealed a moderate positive correlation between the use of modern technology and the adoption of AI, indicating that the availability of digital infrastructure supports the implementation of intelligent solutions within banking institutions.

However, the results did not confirm the existence of a direct and strong impact of either modern technology or AI on financial performance, whether through correlation analysis or linear regression models. The analysis showed that modern technology had a marginal negative effect, while AI did not demonstrate any statistically significant impact. The logistic regression results also indicated that higher levels of modern technology may increase the probability of classification within the low financial performance category, whereas AI showed no significant effect on performance classification.

These findings suggest that the adoption of technology and AI in Algerian banks does not necessarily lead to immediate improvements in financial performance. In the short term, this may be associated with high implementation costs, limited organizational readiness, and insufficient competencies required to transform technological use into financial value. Achieving tangible returns from digital transformation requires complementary factors such as process restructuring, human resource development, and improved management practices.

Based on the empirical findings and the specific context of commercial banks in Tiaret, the following practical recommendations are proposed:

- Banks should invest in upgrading local digital infrastructure, particularly communication networks and system integration, to ensure faster and more reliable service delivery.
- There is a need to recruit and train specialized human resources in financial technologies (FinTech) and artificial intelligence to improve the effective use of digital tools.
- Banks should strengthen internal organizational readiness by aligning technological adoption with managerial practices and operational processes.
- It is recommended to expand the actual implementation of AI applications in areas such as risk analysis, customer service, and decision support.
- Local bank branches in Tiaret should adopt gradual digital transformation strategies that take into account their operational capacity and customer profile

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