International Journal of Research in Finance and Management

P-ISSN: 2617-5754
E-ISSN: 2617-5762
Impact Factor (RJIF): 5.32
IJRFM 2025; 8(2): 550-560
www.allfinancejournal.com
Received: 01-09-2025
Accepted: 04-10-2025

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Mechanisms for activating digital financial inclusion in commercial banks through the application of financial artificial intelligence system requirements: A field study

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DOI: https://www.doi.org/

Abstract
This study provides an overview of the requirements that must be taken into consideration for designing the operation of artificial intelligence systems, presenting the appropriate measures to enhance their development and application, and identifying the impact of these requirements on activating digital financial inclusion mechanisms in commercial banks. The study surveyed the opinions of (259) employees in the Bank of Baghdad and the Iraqi National Bank. It relied on the descriptive and analytical approach, and to achieve the objectives of the study, a questionnaire was used to collect data and analyze it using (SPSS V.26). The study concluded that there is a significant positive impact of applying the requirements of artificial intelligence systems, represented by (material requirements, organizational requirements, human requirements, technical requirements, and security and information protection requirements), in enhancing the effectiveness of financial inclusion in the commercial banks under study. The study recommended that digital financial inclusion should focus on maximizing its impact on beneficiaries through the effective use of artificial intelligence systems and the development of innovative financial solutions that would build a more effective, resilient, and inclusive future.

Keyword: Artificial intelligence systems, financial inclusion, commercial banks

Introduction
Artificial intelligence systems have brought about a fundamental transformation in the financial sector, where they have been distinctly utilized through intensive collaboration between employees and technology. This integration has made financial services more productive, efficient, secure, cost-effective, and profitable, in addition to making them accessible to all members of society. Artificial intelligence systems, along with advanced data analytics and other technologies, can be integrated into the activities of financial institutions to improve their operations and manage risks more effectively. Consequently, artificial intelligence has reshaped financial services and their management, thereby accelerated processes and enhanced their quality.

Artificial intelligence systems are expected to have a major impact across all industrial sectors, with the banking sector among those likely to experience the greatest percentage impact on revenues. AI systems generate value by increasing productivity in the banking sector, ranging between (2.8%) and (4.7%) of total annual revenues globally, equivalent to approximately (200) to (340) billion US dollars resulting from higher productivity and annual revenues (Chui *et al.*, 2023:26) [4]. Projections indicate that AI systems may assist financial institutions in processing up to (90%) of their operations, a significant percentage that could enable the sector to save one trillion US dollars globally by 2030, according to the website (allaboutai).

Research Problem
The world has faced numerous shocks that have intensified development challenges and increased poverty levels among populations. Record levels of debt are constraining countries' abilities to respond to these challenges. In this global context, digital financial

inclusion is considered a fundamental pillar for building a more inclusive and resilient financial system. According to the national strategy issued by the Central Bank of Iraq, financial inclusion in Iraq revealed that only (11%) of Iraqi households own a bank account (Central Bank of Iraq, National Strategy, 2025:28) [20], or an electronic payment account. Therefore, if the revolution of artificial intelligence systems is properly leveraged through the development of new banking models that suit all segments of society, meet their needs more effectively, and reduce costs along the entire value chain of banking services, broad financial inclusion can be achieved. Facilitating access to finance contributes to investment development for individuals, entrepreneurs, and organizations. In this regard, attention should be directed toward increasing the depth of financial inclusion (i.e., the extent of access for individuals and organizations) rather than expanding its scope (the number of individuals and organizations), thereby maximizing the benefits and outcomes for the beneficiaries of financial inclusion. Accordingly, the research problem can be framed by addressing the following question:

Does the application of financial artificial intelligence system requirements have an impact on enhancing digital financial inclusion mechanisms?

Significance of the Study: The significance lies in advancing the level of artificial intelligence system applications due to their substantial impact on expanding both the scope and depth of financial inclusion. Financial inclusion is considered a vital subject, emphasized in the National Strategy for Financial Inclusion 2025-2029 issued by the Central Bank of Iraq. Moreover, artificial intelligence systems represent a rapidly evolving and transformative field capable of reshaping the nature and mechanisms of banking operations. This study also contributes to supporting commercial banks in identifying the requirements for implementing artificial intelligence systems and assisting them in their continuous efforts to activate digital financial inclusion in Iraq.

Research Objectives

The objectives of the study are

1. To identify the awareness of the study sample regarding the concept of financial artificial intelligence and its systems, as well as the concept of digital financial inclusion in the banks under study.
2. To measure the impact of applying financial artificial intelligence systems on enhancing digital financial inclusion mechanisms in the banks under study.

Research Model

Based on the research problem, objectives, and theoretical framework, a hypothetical model for the study has been developed, as illustrated in the following figure:

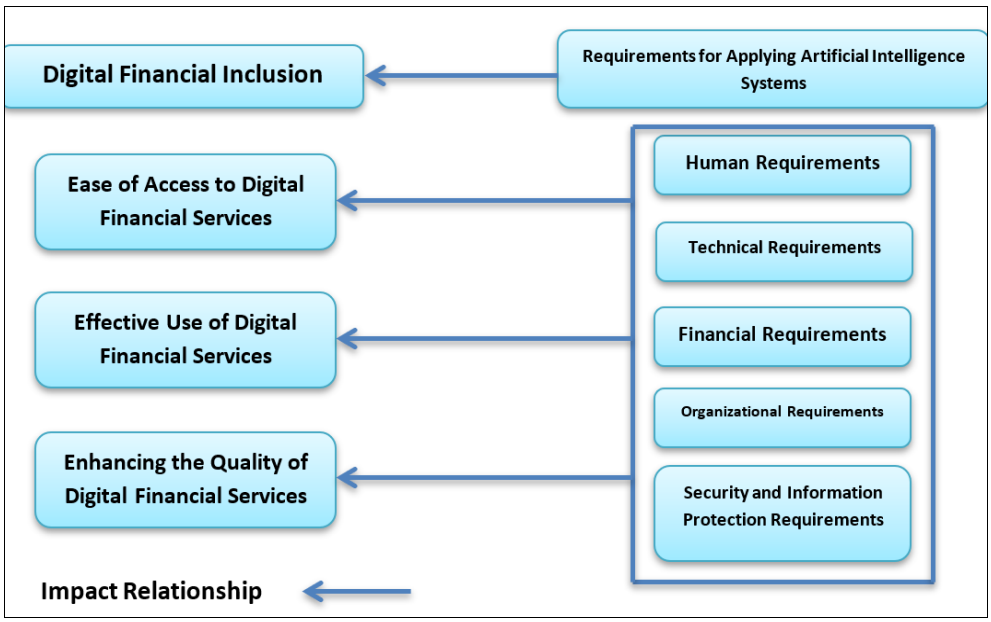

Fig 1: The Hypothetical Framework of the Study

Research Hypotheses

The hypotheses of the study can be summarized as follows:

Main Hypothesis

There is a significant effect between the requirements for applying financial artificial intelligence systems, represented by their dimensions (human requirements, technical requirements, financial requirements, organizational requirements, and security and information protection requirements), and the mechanisms of digital financial inclusion, represented by their dimensions (ease of access to digital financial services, effective use of digital financial services, and enhancing the quality of digital financial services) in the commercial banks under study.

From this, the following sub-hypotheses are derived:

There is a significant effect between the requirements for applying financial artificial intelligence systems, represented by their dimensions (human requirements, technical requirements, financial requirements, organizational requirements, and security and information protection requirements), and the dimension of ease of access to digital financial services in the commercial banks under study.

There is a significant effect between the requirements for

applying financial artificial intelligence systems, represented by their dimensions (human requirements, technical requirements, financial requirements, organizational requirements, and security and information protection requirements), and the dimension of effective use of digital financial services in the commercial banks under study.

There is a significant effect between the requirements for applying financial artificial intelligence systems, represented by their dimensions (human requirements, technical requirements, financial requirements, organizational requirements, and security and information protection requirements), and the dimension of enhancing the quality of digital financial services in the commercial banks under study.

Artificial Intelligence Systems

Artificial intelligence systems have the potential to comprehensively transform the nature of work in organizations, which may lead to new forms of work. These systems are capable of using algorithms that can independently determine the most appropriate action to achieve a specific goal within a defined task. This is what distinguishes them from traditional digitization, which relies on predetermined algorithms designed to solve a specific problem accurately according to predefined programming rules.

According to (Sabira and Saliha, 2021: 273) [18], artificial intelligence systems are defined as a set of systems and theories used to create machines capable of simulating human intelligence by employing learning algorithms to achieve user-specific objectives through the integration of hardware and software. They are systems and devices that simulate the human brain in performing activities and tasks.

(Yuxin *et al.*, 2021: 97) defined artificial intelligence as a new technological science that combines theory, technology, and application systems by conducting computer simulations similar to human thought patterns. (Ozili, 2023: 2) [10] agreed that artificial intelligence systems are simulations of human intelligence through machines programmed to think and act like humans, that is, the intelligence demonstrated by machines.

The researcher concurs with (Sheikh, Prins, and Schrijvers, 2023: 19) [12] in their definition of artificial intelligence systems as systems that exhibit intelligent behavior by analyzing their environment and taking actions with a certain degree of autonomy to achieve specified goals. Accordingly, the performance capabilities of artificial intelligence systems can be described as follows (Peifer & Terstegen, 2024: 739) [11].

- Artificial intelligence systems can process the large and growing volume of data at a speed that surpasses human capabilities.
- Artificial intelligence systems are domain-specific; they cannot transfer what they learn in one field to another.
- The world of artificial intelligence systems is a digital one (zeros and ones), meaning that anything that cannot be mathematically modeled and transferred to the computer cannot be performed by AI systems.
- Many AI applications can be integrated to open up complex practical prospects and possibilities.

The researcher believes that three main factors have contributed to the strong breakthrough of artificial intelligence systems: continuous scientific discoveries in AI systems and applications, significant advances in computing sciences, and the abundance of data.

Types of Artificial Intelligence Systems

Artificial intelligence systems have been classified according to their capabilities into

- **Narrow or Limited AI Systems:** This is the most widespread type, capable of performing a predefined set of tasks without exhibiting any ability to think (Martinez, 2018: 1028) [9].
- **General AI Systems:** This type can perform tasks comparable to those carried out by humans. Currently, there are no machines that function or think like humans, but this may become possible in the future (Al-Qahtani, 2022: 8) [14].
- **Super AI Systems:** In this type, machines are expected to surpass human capabilities, meaning their performance would exceed that of humans, despite the difficulty of achieving this. Some scholars consider it a significant threat to human society (Belbayed & Belabbas, 2024: 16) [15].

Some authors classified artificial intelligence systems based on function into

- **Reactive:** These machines do not possess the ability to store past or future data but rely solely on current data.
- **Limited Memory:** These machines can store past experiences, with self-driving cars being an example.
- **Theory of Mind:** This type is expected to understand the psychological and emotional aspects of the human mind and operate accordingly (Ghosh & Thirugnanam, 2021: 24) [6].
- **Self-Awareness:** These are highly intelligent machines capable of thinking and acting, aware of themselves, and possessing emotions like humans. Research is underway to develop this type, which represents the future of artificial intelligence (Bushnin, 2024: 11) [16].

Artificial Intelligence Systems: Among the most important of these systems are

- **Machine Learning:** Machines are not programmed to perform specific tasks but rather learn automatically and evolve through experience, that is, by developing models capable of learning from data and improving performance over time without the need for explicit programming (Al-Rawazfi & Al-Khiqani, 2024: 96) [13].
- **Natural Language Processing (NLP):** In this system, computers interact with human language, and NLP is used to extract meaning from human languages.
- **Automation and Robotics:** Automation systems generally aim to accomplish routine and repetitive tasks through machines, thereby improving productivity and achieving efficiency. Robotic process automation, however, is programmed to perform a large number of repetitive tasks and adapt to changes under various conditions (Radwan, 2025: 260) [17].

- **Machine Vision:** Cameras are used to capture visual information and then analyze it, where analog-to-digital conversion transforms images into digital data, and digital signal processing is employed to process the data (Kumar *et al.*, 2022: 45) [7].

The researcher believes that financial artificial intelligence systems can strengthen trust with customers in financial institutions, whether through detecting and reducing fraud, educating them about methods of saving, borrowing, and investing, or by assisting them through voice assistants and chatbots in their native language, thereby reinforcing trust by providing customers with multiple options.

Financial Inclusion

Many countries have adopted financial inclusion as a developmental priority and announced national strategies for financial inclusion in an effort to ensure that every individual has access to financial services. This has been pursued through various tools aimed at advancing the objectives of inclusion, such as payment systems, provision of mobile banking services, digital financing programs, financial literacy programs, and others. In Iraq, the Central Bank of Iraq introduced its first National Financial Inclusion Strategy 2025-2029, which envisions going beyond mere access to financial services toward ensuring the use of high-quality, appropriately designed, and affordable financial products through digital channels for all Iraqis.

Financial inclusion was defined in the Central Bank of Iraq's publication within its national strategy (Central Bank, 2025: 5) [20] as: "enhancing access to and use of formal financial services for all segments of the population in Iraq, especially marginalized communities, in an affordable and sustainable manner while ensuring consumer rights protection." Similarly, (Ozili, 2023: 2) [10] defined financial inclusion as the use of formal accounts, i.e., the provision and utilization of essential financial services at affordable costs for all members of society.

The researcher presents a simplified definition of financial inclusion as the process of encouraging and ensuring that all individuals, particularly the poor, have access to and make use of essential financial services (credit, payment, savings) at an affordable cost within a recognized financial institution or in the formal financial sector.

Mechanisms of Digital Financial Inclusion

Ease of Access to Digital Financial Services: This refers to the extent of regulatory, legal, and economic barriers that may limit the ability of financial service users to access services provided by the formal financial sector. It has been established that financing contributes to development at the level of the state, sector, individual companies, and households. Moreover, the removal of restrictions accelerates access to financing and growth for small and medium-sized enterprises, encourages more efficient allocation of assets, and facilitates the entry of new projects into the market, thereby creating a level playing field for businesses (Claessens, 2006: 209) [5].

Effective Use of Digital Financial Services: This indicates the extent to which beneficiaries utilize financial services, measured by indicators such as the percentage of individuals with credit or deposit accounts, the proportion with mobile payment transactions, or those engaged in financial transfers, whether regional or local. Abdul (Kareem, 2019: 31) [1] noted that effective use in financial inclusion refers to regularity, continuity, and frequency in the utilization of financial services. The use of digital financial services is determined by supply-side factors, represented by accessibility, affordability, and service adequacy, as well as demand-side factors, including convenience, timeliness, and literacy.

Quality of Digital Financial Services: Quality is reflected in the excellence, superiority, and high standards of the financial services provided. (Chipunza and Fanta, 2023: 785) [2] indicated that the quality of financial services is summarized by the use of diversified, low-cost, flexible financial products tailored to the needs of beneficiaries. (Chipunza, 2023: 16) [2] further emphasized that quality means beneficiaries will have access to a variety of financial products that are affordable, suitable, and easy to understand. In other words, the quality of digital financial services lies in the degree of excellence in meeting the needs of beneficiaries.

Study Population and Sample: The study population consisted of all employees working in commercial banks operating in Iraq. The study sample was represented by employees of the Bank of Baghdad and the Iraqi National Bank, as they are among the leading commercial banks in the Iraqi banking sector. The questionnaire was distributed electronically to the sample through Google Forms. According to the 2024 reports of the two banks, the number of employees in the Iraqi National Bank was 1,276, while the Bank of Baghdad employed 1,027, with a total of 2,303 employees in both banks. A random sample of 330 employees was selected from the two banks; however, the researcher obtained only 259 responses, representing 78.5% of the total required responses.

Brief Overview of the Study Sample: The Bank of Baghdad was established on February 18, 1992, under license No. (4512) as the first private Iraqi bank, with its headquarters located in Baghdad (Al-Karrada District). As of December 31, 2024, its fully paid-up capital amounted to 400 billion Iraqi dinars. The bank operates 35 branches across Iraq in addition to a branch in Beirut, Republic of Lebanon. It provides a full range of banking and financial services, and all of its shares are listed on the Iraq Stock Exchange (Bank of Baghdad Annual Report 2024: 153) [21].

The Iraqi National Bank was established on January 2, 1995, under license No. M.Sh/582, with its headquarters also in Baghdad (Al-Karrada District). It operates 32 branches across Iraq in addition to a branch in the Kingdom of Saudi Arabia. The bank offers comprehensive banking and financial services and increased its fully paid-up capital to 400 billion Iraqi dinars as of December 31, 2024. All of its shares are fully listed on the Iraq Stock Exchange (Iraqi National Bank Annual Report 2024: 47) [22].

First: Measuring the Reliability of the Study Instrument

To determine the extent to which the instrument consistently produces the same results if reapplied to the study sample,

reliability was measured using the Split-Half method, which relies on dividing the test questions into two halves: the first half consisting of the odd-numbered questions, and the second half consisting of the even-numbered questions, as shown in the following table:

Table 1: Reliability Coefficients of the Study Instrument

Variables	Correlation Coefficient Before Correction	Corrected Coefficient Using Spearman-Brown	N
Financial Requirements	0.736	0.848	259
Organizational Requirements	0.800	0.889	259
Security Requirements	0.792	0.884	259
Human Requirements	0.736	0.848	259
Technical Requirements	0.760	0.864	259
Requirements for Applying AI Systems	0.928	0.963	259
Ease of Access to Digital Financial Services	0.729	0.843	259
Effective Use of Digital Financial Services	0.757	0.861	259
Enhancing the Quality of Digital Financial Services	0.795	0.890	259
Digital Financial Inclusion Variable as a Whole	0.893	0.944	259
Entire Questionnaire	0.949	0.974	259

Prepared by the researcher based on SPSS V.26 outputs.

It is observed from Table (1) that all correlation coefficients before correction were high, exceeding 70%, with the correlation coefficient value for the questionnaire as a whole reaching (0.94). Meanwhile, the corrected coefficients using the Spearman-Brown formula all exceeded 80%. Accordingly, this study instrument demonstrates a high level of reliability that can be depended upon in the present study.

Second: Descriptive Statistics of the Study Variables

The table below presents a summary of the analysis of results related to the opinions of the study sample regarding the study variables and their dimensions, as follows:

Table 2: Summary of the Results of Descriptive Statistical Analysis of the Study Variables

Variable	Arithmetic Mean	Standard Deviation	Relative Importance	Rank
Financial Requirements	3.9066	0.62759	0.78132	1
Organizational Requirements	3.8764	0.62842	0.77528	4
Security Requirements	3.7413	0.71068	0.74826	5
Human Requirements	3.8873	0.63095	0.77746	3
Technical Requirements	3.8965	0.64684	0.7793	2
Variable of AI System Requirements	3.8616	0.57457	0.77232	—
Ease of Access to Digital Financial Services	3.8548	0.67509	0.77096	1
Effective Use of Digital Financial Services	3.7629	0.66369	0.75258	3
Enhancing the Quality of Digital Financial Services	3.8031	0.72646	0.76062	2
Variable of Digital Financial Inclusion	3.8069	0.61141	0.76138	—

Prepared by the researcher based on SPSS V.26 outputs.

It is observed from Table (2) that the arithmetic mean of the variable *requirements for applying artificial intelligence systems* reached (3.86), which represents a high level of acceptance, with a standard deviation of (0.57). This deviation indicates the consistency of responses and their closeness to the arithmetic mean, with a high relative importance of (77%). Among its dimensions, financial requirements ranked first in importance, followed by technical requirements in second place, while human and organizational requirements came third and fourth, respectively, and security requirements ranked last.

It is also noted that the arithmetic mean of the *digital financial inclusion* variable reached (3.80), reflecting a high level of acceptance by the study sample, with a relatively low standard deviation of (0.611) and a relative importance of (76%). The dimension of ease of access ranked first in importance (77%), followed by service quality, and then effective use with relative importance values of (76%) and (75%), respectively.

Third: Results of Testing the Study Hypotheses and Their Discussion: The researcher used simple linear regression to measure the direction and strength of the effect between the study variables, as follows:

Results of testing the hypothesis of the effect of the variable *requirements for applying artificial intelligence systems (X)* on the variable *digital financial inclusion (Y)*, as follows:

Table 3: Regression Coefficients between Artificial Intelligence System Requirements and Digital Financial Inclusion

Variable	R	R^2	Std. Error of Estimate	F	Sig.	Beta	T	Sig.
Requirements for Applying Artificial Intelligence Systems (X)	0.785	0.616	0.379	412.8	0.00	0.835	20.319	0.00

Prepared by the researcher based on SPSS V.26 outputs.

It is observed from Table (3) that the correlation coefficient value reached (0.78), which is a high value indicating a strong positive correlation between the study variables. The value of (R^2) was (0.61), which explains the degree of relationship between the variables, meaning that (61%) of the changes in financial inclusion are attributed to changes in the requirements for applying artificial intelligence systems. The standard error of estimate amounted to (0.37), and since the value is small, this indicates that the model is capable of prediction and estimation. Moreover, the significance levels of both (F) and (T) confirm the validity of the model. Therefore, the main research hypothesis is accepted: there is a significant effect between the requirements for applying financial artificial intelligence (X) and the mechanisms of digital financial inclusion (Y) in the commercial banks under study. The regression equation was as follows:

$$Y = 0.581 + 0.835X$$

It is also noted that the random errors or standardized residuals follow the normal distribution, which is one of the conditions for the validity of the model. In the histogram, most of the data are observed to fall under the normal distribution curve, while in the normal probability plot, most of the points lie on, adjacent to, or close to the line, as shown in the figure below:

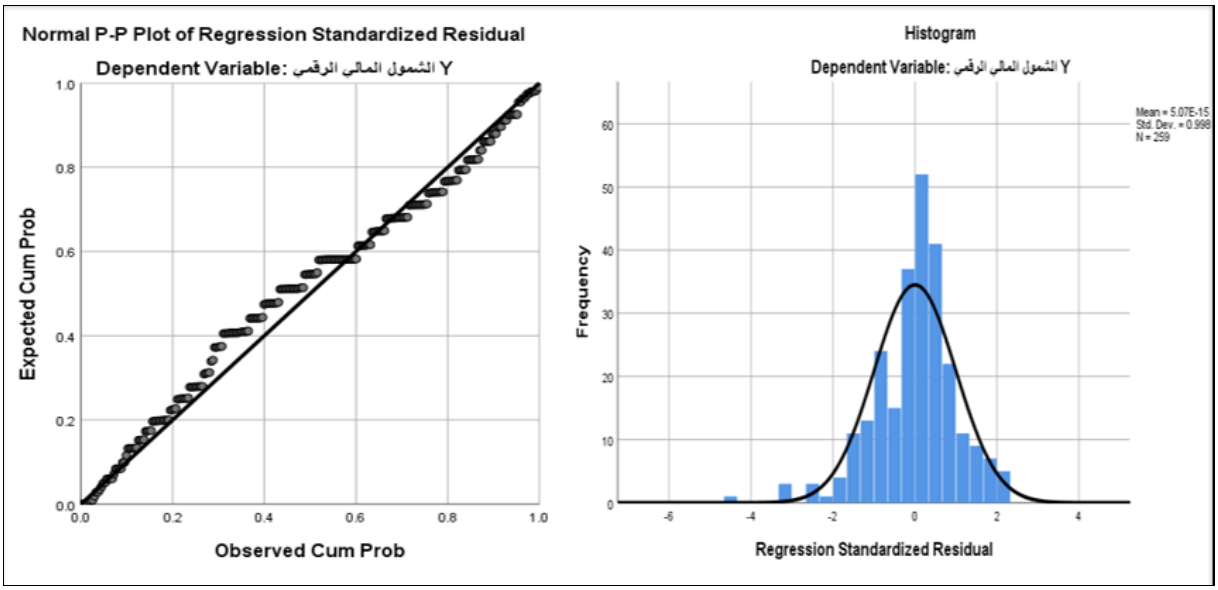

Fig 2: Histogram and Normal Distribution Curve for the Model of the Digital Financial Inclusion Variable

The figure below illustrates the scatter plot of the residuals, where it is observed that most of the residuals are close to zero. This indicates the validity of the model and its ability to predict and estimate.

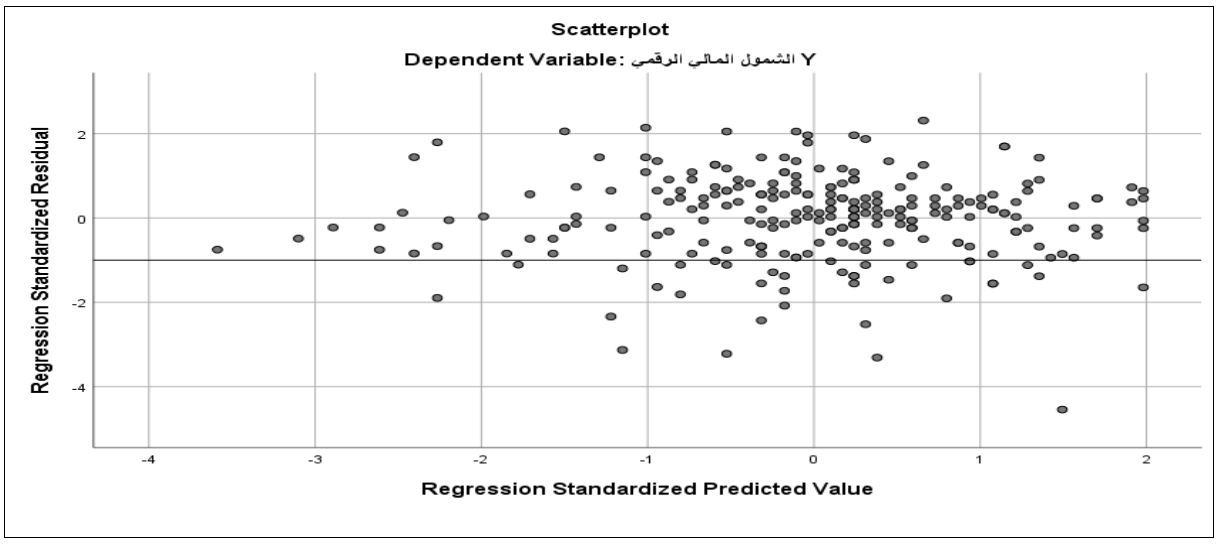

Fig 3: Scatter Plot of the Residuals for the Digital Financial Inclusion Variable

Results of testing the hypothesis of the effect of requirements for applying artificial intelligence systems (X) on the dimension of ease of access to digital financial services (Y1), as follows:

Table 4: Regression Coefficients between the Variable of Artificial Intelligence System Requirements and the Dimension of Ease of Access to Digital Financial Services (Y1)

Variable	Ease of Access to Digital Financial Services (Y1)							
	R	R^2	Std. Error of Estimate	F	Sig.	Beta	T	Sig.
Requirements for Applying Artificial Intelligence Systems (X)	0.645	0.416	0.517	183.02	0.00	0.758	13.52	0.00

Prepared by the researcher based on SPSS V.26 outputs.

From Table (4), it is observed that the value of the positive correlation (R) between the requirements for applying artificial intelligence systems and the ease of access to digital financial services reached (0.64), which is considered a moderate value. The value of (R^2), representing the net explanatory power, indicates that 41% of the variation in the dimension of ease of access to digital financial services is attributable to the variable of artificial intelligence system requirements, while the remaining percentage is due to other variables. The standard error of estimate amounted to (0.517), which is a relatively small value, suggesting that the model is valid for prediction and estimation; that is, the smaller the standard error, the greater the model's predictive and estimation capability. The model is statistically significant, as evidenced by the values of (F) and (T) and their significance levels.

It is also noted that the standardized residuals follow a normal distribution. In the histogram, most of the data fall under the normal distribution curve, and in the normal probability plot, most points lie on or close to the line, as illustrated in the figure below:

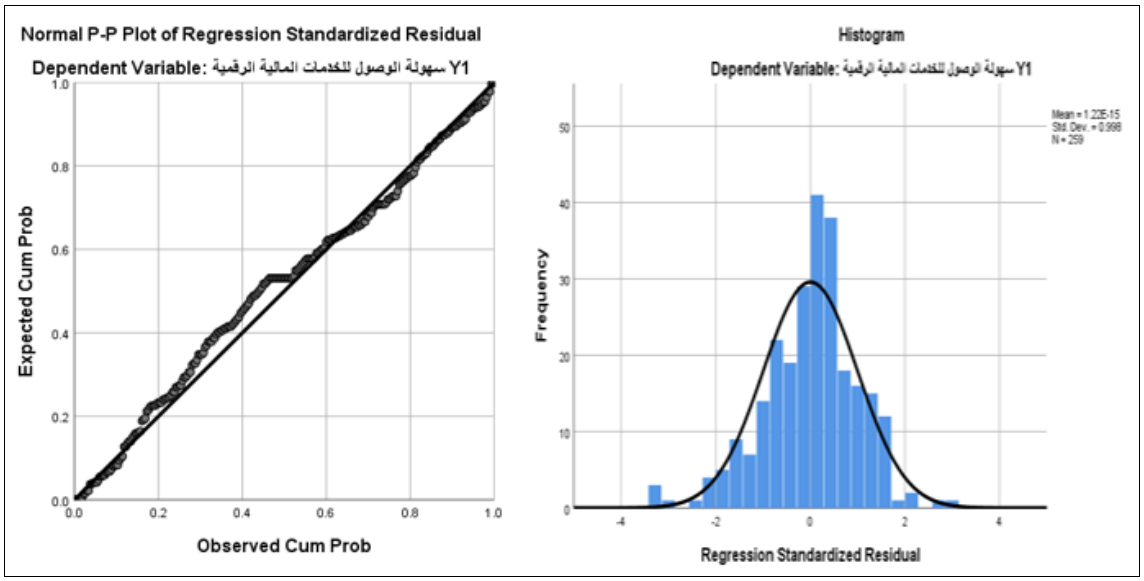

Fig 4: Histogram and Normal Distribution Line for the Model of the Ease of Access to Digital Financial Services Dimension

The following figure illustrates the scatter plot of the residuals, where it is observed that most of the residuals are close to zero.

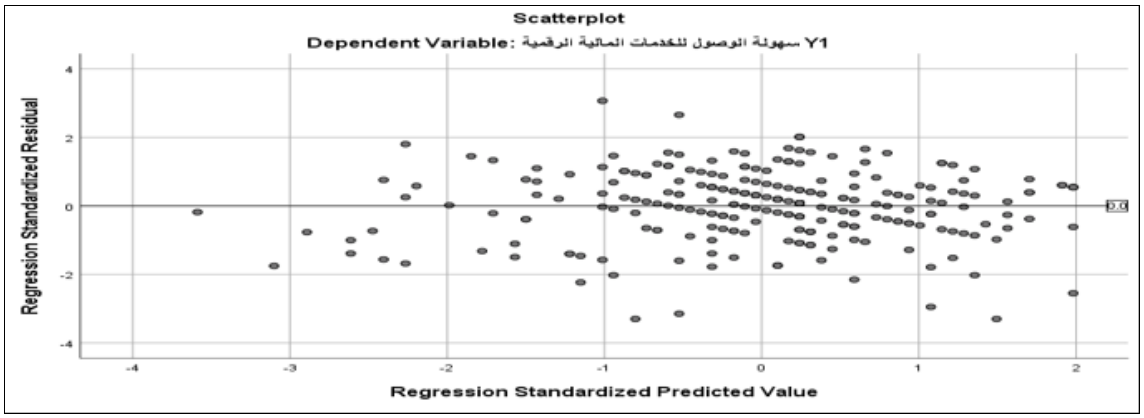

Fig 5: Scatter Plot of the Residuals for the Model of the Ease of Access to Digital Financial Services Dimension

Accordingly, there is a significant positive effect of the variable *requirements for applying artificial intelligence systems (X)* on the dimension of *ease of access to digital financial services (Y1)*, as expressed in the regression equation:

$$Y_1 = 0.929 + 0.758X$$

Results of testing the hypothesis of the effect of *requirements for applying artificial intelligence systems (X)* on the dimension of *effective use of digital financial services (Y2)*, as follows:

Table 5: Regression Coefficients between Artificial Intelligence System Requirements and the Effective Use of Digital Financial Services (Y2)

Variable	Effective Use of Digital Financial Services (Y2)							
	R	R^2	Std. Error of Estimate	F	Sig.	Beta	T	Sig.
Requirements for Applying Artificial Intelligence Systems (X)	0.690	0.476	0.481	233.47	0.00	0.797	15.280	0.00

Prepared by the researcher based on SPSS V.26 outputs.

It is observed that the correlation coefficient (R) was moderate and positive at (0.69), while the coefficient of determination (R^2) reached (0.47), representing the net explanatory power. The standard error of estimate was (0.48), indicating the model's efficiency in estimation. The (F) value was (233.4) with a significance level of (0.00), and the (T) value reached (15.2) with a significance level of (0.00). Therefore, there is a significant effect between the requirements for applying financial artificial intelligence (X) and the dimension of *effective use of digital financial services (Y2)* in the commercial banks under study. The regression equation was as follows:

$$Y_2 = 0.685 + 0.797X$$

It is also noted that the standardized residuals follow a normal distribution, which indicates the validity of the model. In the histogram, most residuals are close to zero, and in the normal probability plot, the majority of the points lie on or near the line, as illustrated in the following figure.

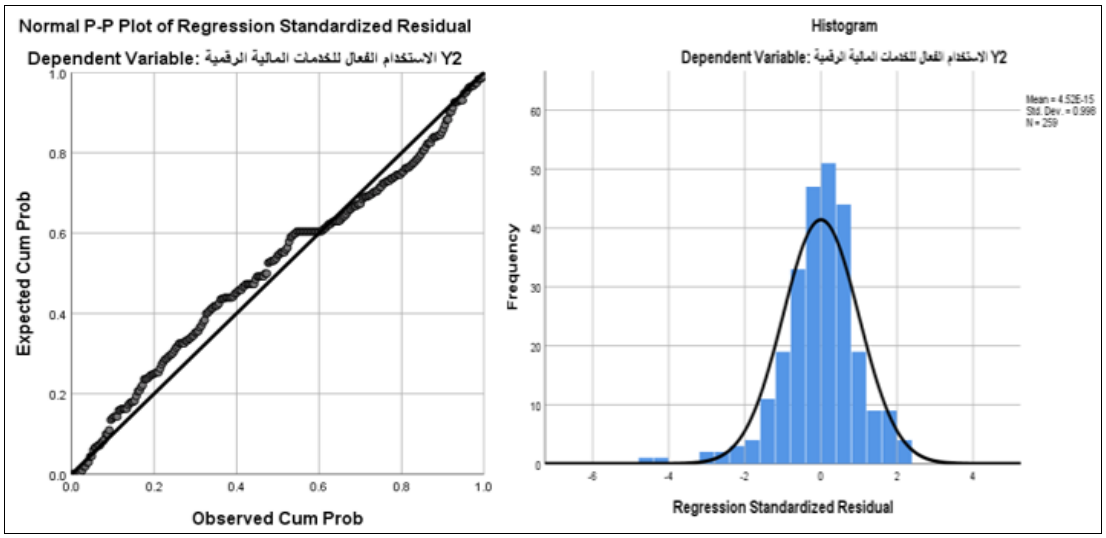

Fig 6: Histogram and Normal Distribution Line for the Model of the Effective Use of Digital Financial Services Dimension

The following figure illustrates the scatter plot of the residuals, where it is observed that most of the residuals are close to zero.

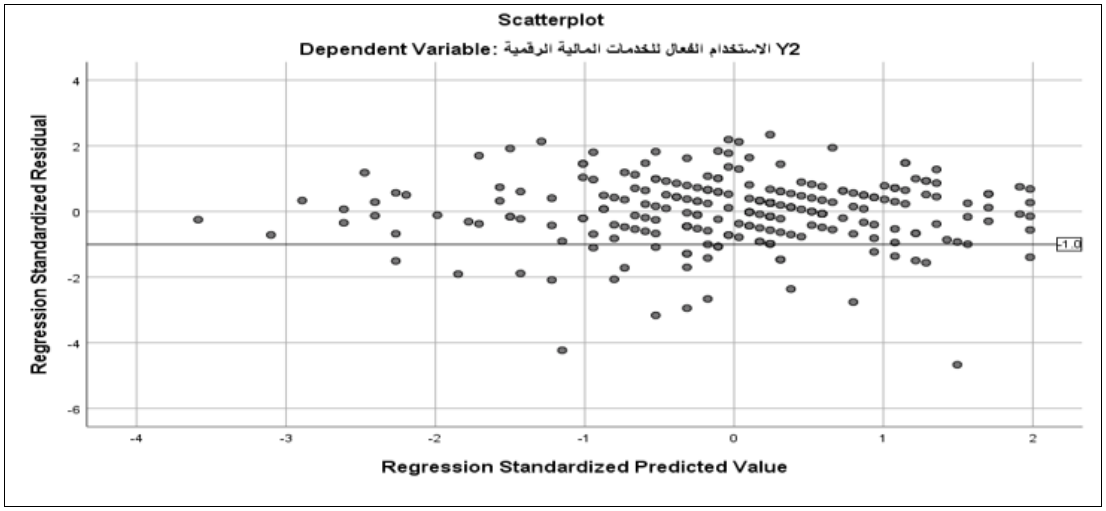

Fig 7: Scatter Plot of the Residuals for the Model of the Effective Use of Digital Financial Services Dimension

Results of testing the hypothesis of the effect of *requirements for applying artificial intelligence systems (X)* on the dimension of *enhancing the quality of digital financial services (Y3)*, as follows:

Table 6: Regression Coefficients between Artificial Intelligence System Requirements and Enhancing the Quality of Digital Financial Services (Y3)

Variable	Quality of Digital Financial Services (Y3)							
	R	R^2	Std. Error of Estimate	F	Sig.	Beta	T	Sig.
Requirements for Applying Artificial Intelligence Systems (X)	0.753	0.566	0.479	335.7	0.00	0.952	18.32	0.00

Prepared by the researcher based on SPSS V.26 outputs.

From Table (6), it is shown that the value of (R) reached (0.75), representing the correlation between the two variables, which is a good positive value. The coefficient of determination (R^2) was (0.56), indicating that 56% of the variation in the quality of financial services is attributed to the requirements for applying artificial intelligence systems. The standard error of estimate was (0.47), a small value that reflects the model's efficiency in prediction and estimation. The validity of the model is also confirmed by the significance levels of the (F) and (T) values. Therefore, the hypothesis stating that there is a significant effect between financial artificial intelligence requirements (X) and the dimension of enhancing the quality of digital financial services (Y3) in the commercial banks under study is accepted. The regression equation was as follows:

$$Y_3 = 0.129 + 0.952X$$

In the figure below, it is observed that most of the data in the histogram fall under the curve, meaning that the standardized residuals follow the normal distribution. In the normal probability plot, the majority of the points lie on or adjacent to the line.

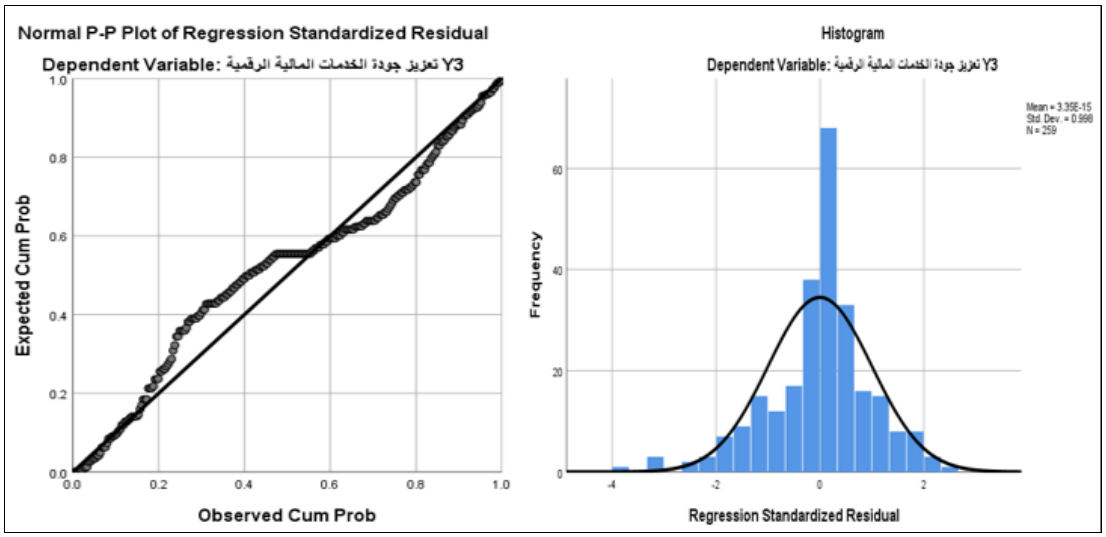

Fig 8: Histogram and Normal Distribution Line for the Model of the Dimension of Enhancing the Quality of Digital Financial Services

The following figure illustrates the scatter plot of the residuals, where it is observed that most of the residuals are close to zero. This indicates the model's predictive and estimation capability.

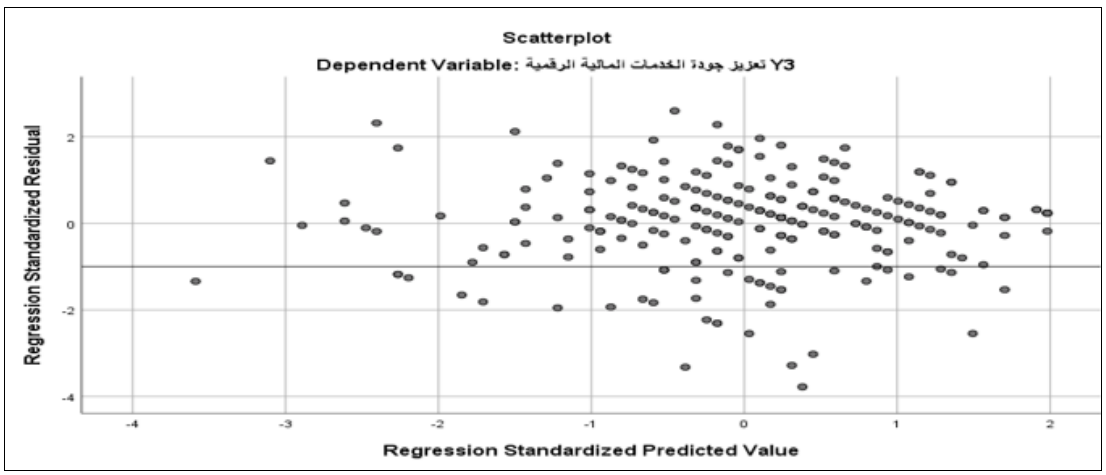

Fig 9: Scatter Plot of the Residuals for the Model of the Dimension of Enhancing the Quality of Digital Financial Services

Conclusions

1. The requirements for applying financial artificial intelligence systems have a clear impact on activating the mechanisms of digital financial inclusion in the commercial banks under study. Especially when these banks keep pace with technological developments and provide their services more effectively, they will achieve broader and deeper financial inclusion.
2. Among the most prominent requirements for applying artificial intelligence systems is the provision of appropriate budgets to enhance the employment of these systems in practice, as well as the continuous development of the professional skills of employees responsible for applying AI systems.
3. The application of artificial intelligence systems requires the availability of technical requirements that accelerate the processes of implementation and success, the dissemination of a culture of digital transformation in work, and the establishment of partnerships with entities that have prior experience in applying AI systems to ensure effective transformation and quality.
4. Planning the tasks related to application requirements within a specific program based on integrated organizational procedures, encouraging innovation in activating the effective use of AI systems, and supporting a culture of knowledge excellence in banking operations.

Recommendations

1. Digital financial inclusion must focus on maximizing its impact on beneficiaries by developing innovative financial solutions that contribute to building an effective, more resilient, and inclusive future.
2. It is necessary to bridge gaps in access to financial services at the national level through the establishment of an effective digital system and by enabling the drivers of financial inclusion.
3. The government and relevant stakeholders in both the public and private sectors should strengthen trust in financial institutions by improving customer protection mechanisms, in addition to enhancing financial and digital literacy.
4. The banking sector should focus on the developmental outcomes of financial inclusion, namely, the benefits derived from financing each activity, thereby achieving the financial well-being of beneficiaries (confidence in their financial future).
5. Partnerships between the public and private sectors should be established, making use of artificial intelligence systems to innovate and develop new financial products and services, thus expanding the scope of financial inclusion and increasing its depth and effectiveness.
6. It is essential to build sufficient expertise in artificial intelligence systems, as excessive reliance on system outputs without professional human oversight may lead to heightened risks and undermine consumer protection.

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