International Journal of Data and Network Science 9 (2025) 317–322

Contents lists available at GrowingScience

International Journal of Data and Network Science

homepage: www.GrowingScience.com/ijds

The impact of artificial intelligence on the development of electronic financial services

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C H R O N I C L E

Article history:
Received: July 11, 2024
Received in revised format: August 2, 2024
Accepted: August 11, 2024
Available online: August 11, 2024

Keywords:
Artificial intelligence
Electronic financial services
Commercial banks
Jordan

A B S T R A C T

The study aimed to examine the impact of artificial intelligence on the development of electronic financial services. The population of the study involves employees from Jordanian commercial banks distributed across branches and the general administration. The researcher used a survey as the study instrument to collect data from the study sample, with 356 surveys distributed via a link. The Statistical Package for the Social Sciences (SPSS) was used to analyze the data. The results showed an impact of using artificial intelligence on the development of electronic financial services in Jordanian commercial banks. One of the prominent recommendations was for the management of commercial banks to keep pace with the advancements and developments in artificial intelligence and the expert systems environment by providing advanced operating and storage systems to keep up with the developments in electronic financial services.

1. Introduction

Keeping up with modern technological developments is crucial for the survival and continuity of organizations in general and commercial banks in particular (Garg et al., 2018). It significantly impacts the continuity of their operations and their competitive position (Chukwudi, 2018). These rapid technological changes have led to strong competition among various banks, resulting in a race to acquire such electronic services that have clearly contributed to the speed of customer transactions and effective management of their interests, which involve multiple financial engagements managed with the utmost precision and confidentiality under a secure framework of procedures (Al-Taesh, 2016). With many banks adopting and developing these services through cloud computing, and with many of these services linked to financial institutions that partner in providing and completing these services for customers, the electronic services offered have become a unified model across all these banks. To compete in light of developments in communications and information technology, it has become necessary to employ artificial intelligence in managing these services (Ilag & Athave, 2019). The use of artificial intelligence represents an unconventional approach due to the advanced capabilities it offers, which are difficult to overlook, and its advantages in terms of time, effort, cost, and the preparation of human resources capable of handling such activities. This significantly contributes to achieving the goals of bank management,

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ISSN 2561-8156 (Online) - ISSN 2561-8148 (Print)

doi: 10.5267/j.ijdns.2024.8.012

overseeing different activities, and achieving performance effectiveness in service delivery (Mhlanga, 2020; Taybi, 2023). Jordanian commercial banks are working diligently to improve their institutional performance to achieve efficiency and effectiveness by adopting electronic service models. This requires providing human resources that are characterized by creativity and innovation in all banking processes within banks. To face these challenges and achieve the desired goals, it has become necessary to adopt artificial intelligence and integrate it through electronic financial services offered through the electronic cloud or service-providing companies or other distribution outlets offered by banks (Xie, 2019). Therefore, it has become essential to highlight how the use of artificial intelligence affects the development of financial services. The study seeks to assist officials and decision-makers in Jordanian commercial banks in improving the performance of financial services by highlighting the key elements utilized through artificial intelligence that support the processes of providing electronic services. It also demonstrates the level of artificial intelligence use in Jordanian commercial banks (Yellapantula & Ayachit, 2019).

2. Theoretical Framework and building hypotheses

2.1 Artificial Intelligence

Al-Abdallat (2020) stated that artificial intelligence is a collection of efforts aimed at developing information systems in a way that allows them to act and think similarly to humans, accomplishing tasks in a coordinated manner while simultaneously storing human experiences and accumulated knowledge from various experiments to be used in decision-making processes. Bin Al-Tayeb and Mahloul (2019) defined artificial intelligence as one of the experimental branches of computer science, whose main task is to find intelligent devices capable of performing complex tasks by relying on their intelligence. This represents a development of computer systems to make them capable of completing tasks that typically require human intelligence to find solutions, such as auditory and visual perception, decision-making, and translation into multiple languages. Based on the, we see that artificial intelligence is primarily linked to modern technical devices and innovative software, and it has become available across all sectors around the world, such as software for translation, automated robots, drones, cognitive simulation programs, and computer applications in medicine and engineering, as well as in financial institutions like banks and financial services. The components of artificial intelligence are:

Expert Systems: Expert systems rely on a wealth of information and previous experiences, through which they search for and find solutions. The expert system helps in the ability to make decisions, solve problems, and explain procedures (Taybi, 2023).

Chatbots: As defined by Peters (2018), a chatbot is an abbreviation of “chat”, derived from “chatter”, which means talking in a friendly and concise manner. The second part, “bot”, is derived from "robot," indicating an automated device. It refers to programs that simulate conversation with humans and relies on instant messaging platforms to carry out its functions, serving as a personal assistant in daily life.

Intelligent Agent: An intelligent agent refers to input and sensor devices that read the surrounding environment and are connected to output devices or control units. They consist of visual and auditory sensors that simplify many tasks and link certain information to devices that provide services to customers (Shifa & Rajm, 2017; IA & Miglionico, 2019).

2.2 Financial Services

These are a series of beneficial operations with a high proportion of intangible components compared to tangible ones. People and organizations understand these operations through their implications and usefulness, which provides a means of meeting their present and future credit and financial needs. Al-Makbati (2018) listed a few of these offerings, which consist of:

- Electronic Check: This is an electronic communication that is signed and contains required information about the parties to the transaction. It allows the due amount to be transferred to the beneficiaries over the internet.
- Bank Transfer: In this procedure, a written electronic order with a matching signature is used as the basis for a bank to debit money from the ordering party's (the first party's) debit side account. Whether or not both parties are bank clients, the identical amount is simultaneously credited to the credit side of another account (the second party).
- Bank Card: This is an electronic card that a bank or other financial institution issues. With it, the bearer can get a loan, make purchases on credit from the issuer, and carry out a restricted number of other transactions without physically visiting the bank.

2.3 Artificial Intelligence and Electronic Financial Services

Taybi (2023) outlines artificial intelligence's impact on the financial industry and the benefits it can provide to commercial banks through enhanced productivity and higher profitability. One of the main conclusions was that artificial intelligence significantly affects commercial banks' performance. Bounia (2023) explored the feasibility of applying artificial intelligence methods to estimate creditworthiness in Algerian banks by modeling the artificial neural network technique and expert systems on a sample of

145 institutions and 18 quantitative and qualitative variables from a specific Algerian bank. One of the most notable conclusions was that there is a statistically significant relationship between the artificial neural network model and the expert system and creditworthiness estimation, with the methods achieving correct classification rates of 92% and 97%, respectively. Kaur et al. (2020) define the concept of artificial intelligence in banking and how AI changes the face and direction of modern banks. Among the key findings were: artificial intelligence helps in integrating banking services into banks and promotes faster growth and expansion. AI also increases customer attraction by accelerating the processing of small transactions. Ris et al. (2020) shed light on the need to improve efficiency and effectiveness in service delivery, increase financial institutions' profits, and replace human factors with automated virtual assistants and chatbots. Among the key findings were: AI-powered virtual assistants improve the performance of business operations in every sector, especially the banking sector, making it faster, more reliable, and less dependent on humans. Thommandru et al. (2022) explore the impact of artificial intelligence on electronic banking services and the development of financial technology. Among the key conclusions were: the significant impact of artificial intelligence on financial technology. Artificial intelligence includes machine learning, a subset of artificial intelligence, and AI can more easily interpret and modify data structures if based on a solid foundation. Based on above, the study hypotheses may be as:

H_1: *There is an effect of artificial intelligence on the development of electronic financial services.*

2.4 Study Model

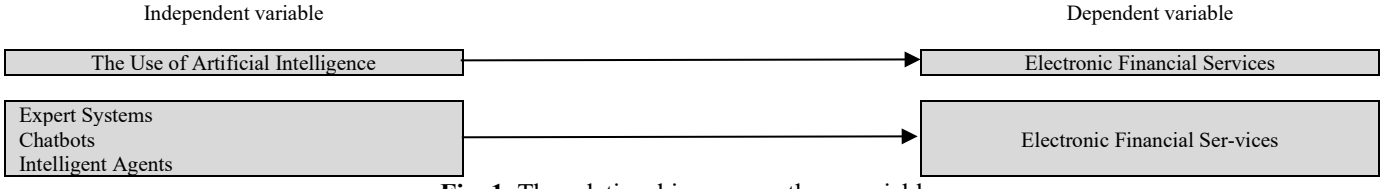

Fig. 1. The relationships among these variables

3. Methodology of the study

3.1 Population and sample

By reviewing the Amman Stock Exchange website for 2022, the total number of employees in Jordanian commercial banks was 15,380, distributed among branches and the general administration. The researcher relied on the information from the Amman Stock Exchange website to define the study population. The researcher used the study population's size of 15,380 employees. According to the Bougie and Sekaran (2019), the appropriate and representative sample size should be 375 employees. Questionnaire was used to collect data from the employees of the Jordanian commercial banks, and an electronic form was designed to facilitate distribution to employees in these banks. A total of 356 questionnaires were retrieved valid for statistical analysis.

3.2 Reliability

Table 1
Measurement of Questionnaire Reliability

Sections	Number of Sections	Section Numbers	Cronbach's Alpha
Expert Systems	6	1-6	0.841
Chatbots	5	7-11	0.822
Intelligent Agents	5	12-16	0.801
Financial Services	7	17-23	0.882
Overall Total			**0.901**

As seen from Table 1, the Cronbach's Alpha coefficients for the variable sections range between (0.801) and (0.882), which is considered acceptable in social sciences according to Bougie and Sekaran (2019). This indicates that the questionnaire sections are reliable.

4.3 Descriptive Results for Study Variables

Artificial Intelligence Usage

It can be observed from Table 2 regarding the Artificial Intelligence Usage dimensions that the Expert Systems was highest mean, with a mean of 3.83. Chatbots was the second order with a mean of 3.75. Finally, Intelligent Agents was the lowest mean of 3.72. The overall usage of Artificial intelligence was high with a mean of 3.76. were high.

Table 2
Results of Community Members' Opinions on Artificial Intelligence Usage

Number	Dimension	Mean Score	Level
1	**Expert Systems**	3.83	High
2	**Chatbots**	3.75	High
3	**Intelligent Agents**	3.72	High
	Overall for Artificial Intelligence Usage	3.76	**High**

Electronic Financial Services

Table 3
Results of Community Members' Opinions on Electronic Financial Services

Question Number	Items	Mean	SD	Rank	Level
17	Using chatbots enables interactive conversations with customers	3.69	1.086	4	High
18	Expert systems contribute to providing smart databases	3.56	1.127	7	Medium
19	Intelligent agents enhance efficiency in service delivery to customers	3.61	1.121	5	Medium
20	Artificial intelligence contributes to the development of financial services by facilitating service delivery to customers	3.58	1.067	6	Medium
21	Chatbots meet customer expectations for services provided	3.84	.929	3	High
22	Expert systems contribute to making appropriate decisions	3.86	.795	2	High
23	Artificial intelligence contributes to connecting services to multiple distribution centers	3.96	.759	1	High
	Overall for electronic services	3.72			**High**

4.4 Normality

If the skewness coefficient is zero or close to it, and the kurtosis coefficient is three or close to it, this indicates that the data follows a normal distribution. Table 4 shows the results.

Table 4
Data for Normal Distribution of Study Variables

	Expert Systems	Chatbots	Intelligent Agents
Skewness (Skewness Coefficient)	-0.521	-0.632	-0.3021
Kurtosis (Kurtosis Coefficient)	1.211	0.312	0.2912

Table 4 shows the results of the normality test for the variables using the skewness and kurtosis coefficients. It indicates that all skewness coefficients are close to zero, with the lowest value for Intelligent Agents at -0.3021. As for kurtosis, all variables have values close to three, with the lowest value for Chatbots at 0.312. This suggests that the data follows a normal distribution.

4.5 Variance Inflation Factor (VIF) Test for Study Variables

Table 5
Result of Multicollinearity Test Among Independent Variables

Variable	Tolerance	VIF	Result
Expert Systems (Dimension 1)	0.421	1.662	No Multicollinearity
Chatbots (Dimension 2)	0.219	1.712	No Multicollinearity
Intelligent Agents (Dimension 3)	0.692	1.310	No Multicollinearity

From Table 5, we can see that the Variance Inflation Factor (VIF) values for all study dimensions are below 10, indicating no significant multicollinearity among the independent variables, making the data ready for analysis. The Tolerance values for all dimensions are above 0.05, indicating no significant multicollinearity among the independent variable dimensions. This allows all of them to be used in the regression model to determine which of these dimensions has a statistically significant impact on the dependent variable.

4.6 Analysis

To analyses the study data and achieve the study objectives, the researcher used SPSS Program.

Table 6
Results of Multiple Regression

	B	Std. Error	t	Sig.	Beta
(Constant)	0.294	0.166	1.771	0.077	
Expert Systems	0.422	0.061	7.219	0.000	0.403
Chatbots	0.250	0.067	3.748	0.000	0.243
Intelligent Agents	0.213	0.058	3.648	0.000	0.190

The study hypothesis was tested at a significance level of ($\alpha \leq 0.05$), and the results were as follows: The B-value for the constant was (.294), essential for constructing the regression equation, as follows: Development of Electronic Financial Services = (.294) + .422 Expert Systems + .250 Chatbots + .213 Intelligent Agents. Based on the above, the study hypothesis was accepted, which states that there is a statistically significant effect of use of artificial intelligence on the development of electronic financial services.

Fig. 2 illustrates the scatter plot for the relationship between the dimensions of artificial intelligence (expert systems, chatbots, intelligent agents) and the development of electronic financial services in commercial banks.

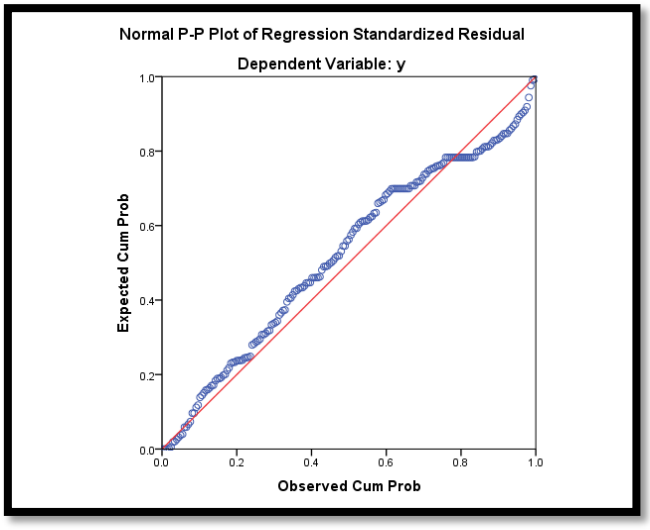

Fig. 2. Scatter Plot of the Relationship between Artificial Intelligence Dimensions and Development of Financial Services

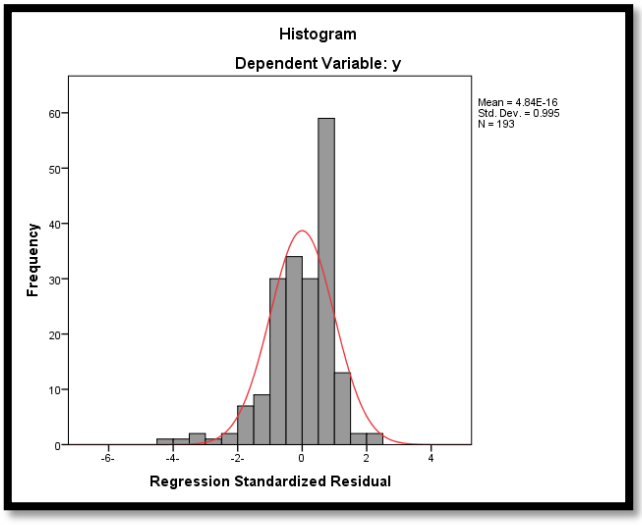

Fig. 3. Histogram and Normal Distribution Curve for Residuals of the Regression Model

The previous graph shows that the degree of relationship between the study variables is strong but not absolute, as there is a dispersion of points in the scatter plot around the straight line, which represents a perfect relationship if (R=1). The proximity of the points to the straight line indicates the strength of the relationship. To verify the validity of the fitted regression model, the Fig. 3 indicates that the probabilistic distribution of the residuals from the regression model is close to a normal distribution.

5. Discussion

After conducting the statistical analysis, the study results showed a high level of artificial intelligence use in electronic financial services among Jordanian commercial banks. Which means that commercial banks clearly rely on expert systems by providing databases containing many possible scenarios for certain problems and ways to solve them. These systems help the bank in service development and in making appropriate decisions if some issues arise. It is clear from the sub-section means for this dimension that they were high. Also, chatbots create interaction with customers through guidance and the ability to speak in multiple languages to meet customer needs, which is reflected in the sample's answers. The researchers conclude from the sample responses that intelligent agents contribute significantly to enhancing visual and auditory sensors and act on behalf of banks in making certain partial decisions.

The study results showed that there is an effect of artificial intelligence on the development of electronic financial services This result aligns with the study by Taybi (2023) results which showed an effect of artificial intelligence on the commercial banks performance. Bounia (2023) concluded that there is a statistically significant relationship between the artificial neural network model and the expert system and creditworthiness estimation, with the methods achieving correct classification rates of 92% and 97%, respectively. Kaur et al. (2020) identified that artificial intelligence helps in integrating banking services into banks and promotes faster growth and expansion. AI also increases customer attraction by accelerating the processing of small transactions. The study is also consistent with Thommandru et al. (2022) which identified that Artificial intelligence includes machine learning, a subset of artificial intelligence, and AI can more easily interpret and modify data structures if based on a solid foundation.

6. Recommendations

Based on the previous results, the authors recommend managers and decision makers of commercial banks to keep pace with progress and developments in artificial intelligence and expert systems by providing advanced operating and storage systems to

match the advancements in electronic financial services. Managers also have to integrate artificial intelligence activities and technologies into the tasks of bank employees in commercial banks and stay updated with the latest developments to be able to interact with these systems.

Acknowledgement

The Researchers would like to thank the Deanship of Graduate Studies and Scientific Research at Qassim University for financial support (QU-APC-2024-9/1).

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