The Effect of Artificial Intelligence on Financial Performance in The Egyptian Banking Sector

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Abstract:

Continuous developments vitally impact the commercial and financial areas, and one of the most important technologies is artificial intelligence (AI). Despite financial aspects facing a lot of challenges due to using AI, there are many opportunities that should be explored. The main purpose of this study is to explore the effect of using artificial intelligence on the financial performance of banks in Egypt. The study's objective was accomplished by using a quantitative approach, and data analysis was done using path analysis. This study demonstrates how banks can use AI technologies to enhance their liquidity and profitability, and hence, financial performance consequently increases the trust of stakeholders. This study provides thorough insights that can help organizations and policymakers effectively utilize AI technology for improved financial performance. The study's findings have significant real-world repercussions for banks and their financial performance. Finally, this study

provides recommendations for future research and practical implications that lead to more improvement in both academic and professional fields.

Keywords: Artificial Intelligence, Financial Performance, Liquidity, Profitability.

ملخص البحث:

تؤثر التطورات المستمرة بشكل حيوي على المجالات التجارية والمالية، وأحد أهم التقنيات هو الذكاء الاصطناعي (AI). وعلى الرغم من أن الجوانب المالية تواجه الكثير من التحديات بسبب استخدام الذكاء الاصطناعي، إلا أن هناك العديد من الفرص التي يجب استكشافها، والغرض الرئيسي من هذه الدراسة هو استكشاف تأثير استخدام الذكاء الاصطناعي على الأداء المالي للبنوك في مصر، وقد تم تحقيق هدف الدراسة باستخدام نهج كمي، وقد تم إجراء تحليل البيانات باستخدام تحليل المسار. توضح هذه الدراسة كيف يمكن للبنوك استخدام تقنيات الذكاء الاصطناعي لتعزيز سيولتها وربحيتها، ومن ثم فإن الأداء المالي يزيد من ثقة أصحاب المصلحة، تقدم هذه الدراسة رؤية شاملة يمكن أن تساعد المؤسسات وصانعي السياسات على استخدام تقنية الذكاء الاصطناعي بشكل فعال لتحسين الأداء المالي، ولنتائج هذه الدراسة تداعيات واقعية كبيرة على البنوك وأدائها المالي،وأخيرًا، تقدم هذه الدراسة توصيات للبحوث المستقبلية وتوضح الآثار العملية التي تؤدي إلى مزيد من التحسن في كل من المجالات الأكاديمية والمهنية.

الكلمات المفتاحية: الذكاء الإصطناعى، الأداء المالى، السيولة، الربحية.

1- Introduction:

The use of AI is growing worldwide, with more businesses integrating technology into at least one business unit or function (Shiyyab et al., 2023); hence**,** the businesses can operate very smoothly (Njegovanović, 2018). Numerous industries have seen radical change as a result of artificial intelligence's (AI) quick development, and accounting is no exception (Hasan, 2021; Malviya and Lal, 2021). Artificial intelligence and other new digital solutions such as, cloud computing, big data, blockchain, and continuous accounting, will improve data speed, quality, and accuracy while decreasing the need for manual data entry (Njegovanović, 2018).

According to some scientists, artificial intelligence will soon surpass human intelligence, and others contend that human intelligence is too complex to be replicated or replaced by a machine and that the human mind is extremely complicated (Njegovanović, 2018). Because accounting is a traditional profession, its rules and principles have been set and maintained for many years, the adaptation of technical advancements will be without sacrificing fundamental accounting rules and principles, which is one of the challenges facing the accounting profession (Gulin, et al., 2019).

1.1 Research gap:

Some individuals are anxious to implement the new technologies because of the great uncertainties that the new technologies bring to their businesses (Winata and Sukarno, 2024). Businesses are even less persuaded about whether implementing AI will improve its financial performance because there is a shortage of research in this area (Winata and Sukarno, 2024).

Some previous studies explored the effect of AI on financial performance through a comprehensive review of the literature. For empirical studies, the data collection tools in several studies were questionnaires, interviews, and focus groups that may introduce bias as data can be subject to respondent bias, and participants' responses could be influenced by the researcher's presence or the group dynamic, hence, data may not always reflect the actual practices.

Furthermore, some studies that use a quantitative approach seem to be cross-sectional, capturing a snapshot in time regarding the effect of AI on financial performance. Then, a longitudinal approach could have yielded a deeper understanding of how this relationship changes over time.

Moreover, the studies that conducted its empirical research on bank sector have used return on equity (ROE) and return on assets (ROA) to measure the financial performance which is not relevant enough for banks and this research use liquidity and

profitability ratios to produce a comprehensive picture about the financial performance in bank sector.

1.2 Objective of the study:

Artificial intelligence (AI) has advanced so quickly in recent years that it is now routinely applied in many different areas of the financial field and makes a significant impact (Xie, 2019, April). The main objective of this research is to explore the effect of expanding the use of AI in the Egyptian banking sector on its liquidity and profitability.

1.3 Significance of the study:

Businesses are finding artificial intelligence (AI) to be more and more essential as it provides several benefits for competing in the ever-changing market environment of today, that lead companies to spend more investment on AI technologies in order to obtain a competitive edge, then examining the connection between these advancements and businesses' income is crucial (Abdul, 2024) specially, using AI requires financial sacrifices.

On the other hand, the topic of financial performance has drawn a lot of interest from academics because it significantly affects the overall goals of the business (Deribie and Habtewold, 2023). Because the main purpose of any business is to make a profit, and financial performance has a significant effect on business

performance as well as its profit, then exploring the effect of AI on financial performance is essential.

The rest of this research is structured as follows: Section 2 presents the literature review that led to hypotheses development. Section 3 describes the methodology, and then the data analysis is discussed in Section 4. Finally, the conclusion, recommendations, and future research are presented in section 5.

2- Literature Review:

2.1 Theoretical Background:

2.1.1 AI

Artificial intelligence (AI) is the transfer of human intelligence to machines (Shiyyab et al., 2023), and it has been defined as the imitation of human intelligence in computers that can carry out tasks that people typically do and often require human intelligence, like problem-solving, speech recognition, visual perception, decision-making, and learning (Huang et al., 2019; Goralski and Tan, 2020; Zhang et al., 2020; Manne and Kantheti, 2021). In other words, artificial intelligence refers to the discipline of science concerned with creating intelligent computers that can simulate human intelligence and behavior (Ottosson and Westling 2020), and includes the development of synthetic minds that can plan, learn, perceive, or process natural language (Paulraj and Neelamegam, 2014).

The study of Akour, et al, 2024 has referred to the two types of artificial intelligence. The first one is the narrow AI that is defined as the computer programs designed and taught to efficiently do specific tasks or deal with particular problems (De Bruyn et al., 2020). The second type is the general AI, which systems with intelligence comparable to that of humans and the ability to perform any intellectual task that a human being is capable of (Sangeetha et al., 2022) and have vast and versatile cognitive capacities, allowing it to transmit knowledge and skills across areas (Haenlein and Kaplan, 2019).

As more potent computing systems and a huge volume of data became available in the 21st century, the important developments and real-world uses of AI began to pick up steam (Ratia et al., 2018; Haenlein and Kaplan, 2019) because of the ability of AI to help process huge data (Abdul, 2024). Then, the world could be changed by AI, and almost every commercial operation uses artificial intelligence (Akour et al., 2024) that has significantly changed how businesses operate, causing a move away from traditional approaches and toward technology-driven procedures (Abdul, 2024). Furthermore, it is moving from the operational to the strategic domains (Jarrahi, 2018).

AI is not merely a trend; it is a reality that is fundamentally changing how businesses manage their money and assets, besides, the use of AI is going to bring about a significant shift in

the way financial decisions are made (Hidayat et al., 2024). One of the main effects of accounting information system on businesses is anticipated to be the information technology (IT) component of the accounting information system, which makes it simple for businesses to track, document, and report on financial and accounting data, consequently, many organizations adopted the accounting information system to automate and integrate their company activities to have productivity, and competitive advantages (Ali and Oudat, 2021).

2.1.2 Financial Performance:

The ability to manage and run the business effectively, make a profit, remain alive, grow, and make a response to the environmental challenges and opportunities refers to the performance of the business (Mawanda, 2008) and the financial performance is a subjective measure of how efficiently a firm can utilize resources from its fundamental way of operation and generate profits (Ejoh and Ejom, 2014). It means that financial performance refers to a method for calculating the financial effects of a company's commitments and activities (Whittington and Pany, 2001) hence, financial performance is a monetary indicator of its operations and policies (Kinyua, 2016).

On the other hand, the collection of interconnected components, tools, processes, equipment, and software that work together to solve financial analysis, control, and supply it as required is the

accounting information system (Sari et al., 2019) that involves three types of resources: human resources, material resources, and financial data (Tjahjadi and Soewarno, 2019). The ability of AIS to perform accounting activities and tasks for businesses is what makes AIS significant (Elsharif, 2019), and consequently has the main responsibility for the financial performance of the business (Al-Hashimy et al., 2022).

2.2 Research hypotheses development:

In their investigation, Hashem and Alqatamin, 2021 improving the efficiency of artificial intelligence strengthens the efficiency of the systems applied inside the organization and hence raises the efficiency of performance. The study by Al-Hashimy, et al., 2022 showed that the technological framework of computerized accounting information systems significantly improved the financial performance of construction enterprises. The study by Shiyyab et al., 2023 concluded that stability, increased profitability, improved financial service delivery efficiency, and systemic risk monitoring and regulation are some of the advantages AI offers financial institutions. Likewise, the results of the study by Uz-Zaman et al., 2023 emphasized that investment in technology is crucial for any service-oriented business, as well as the banking sector, because it will improve operational efficiency and lower the cost-to-income ratio in the long run.

On the other hand, the study of Yao et al., 2023 investigated the mediating role of artificial intelligence between accounting information systems and financial performance. This study explored how artificial intelligence (AI) can improve accounting information systems (AISs) for financial performance. The results revealed that artificial intelligence (AI)-powered accounting information systems can improve decision-making, financial reporting accuracy, and overall corporate effectiveness. It also supports financial management by providing help in processing a huge volume of data, determining recurring structures in data and exceptions, automating the routine tasks, and offering insights in real time. Consequently, using AI in accounting information systems can enhance financial performance. Likewise, the study by Hidayat et al., (2024) referred that artificial intelligence (AI) is being used in financial management in several ways to enhance productivity, analysis, and decision-making which demonstrate how artificial intelligence has developed into a useful instrument for financial management process and decision optimization, adding value through more complex data analysis and flexible solutions.

The study by Winata and Sukarno, 2024 provided an overview of the literature on digitalization and highlighted its impact on financial performance and demonstrating that artificial intelligence, in addition to online technologies, cloud computing, process automation, big data analytics, computer simulations, and the Internet of Things,

impacts financial performance. Akour et al., 2024 investigated how artificial intelligence aspects such as computer vision, machine learning, natural language processing, and expert systems affected pharmaceutical businesses' financial decisions and suggested that financial decisions are positively impacted by artificial intelligence's aspects.

For the banking industry, Doumpos et al., (2023) also emphasized that AI would improve financial measurements in the banking sector. Likewise, the findings of Shiyyab et al., 2023 inferred that the financial performance of banks is impacted by the disclosure of AI-related terms, as well as, Artificial Intelligence (AI) enhances accounting performance in terms of ROA and ROE but has a negative impact on overall expenses which indicate that AI increases revenue while decreasing costs. In addition to that, the study by Hidayat et al., (2024) discussed the significant advancements made possible by the application of AI to present deep insights for financial decision-making, improve operational performance, besides enhance customer experience in the banking industry.

Contrary to the previous research, the results of Purwaningsih et al., 2024 concluded that it is not proven that technology has a direct impact on the financial performance of small and medium-sized enterprises.

Because of the results of the previous studies, this study will test the following hypotheses:

H1: AI has a positive and significant impact on the bank's liquidity.

H11: AI has a positive and significant impact on the loan-to-deposit Ratio

H12: AI has a positive and significant impact on the Cash and Cash Equivalents to Total Assets

H13: AI has a positive and significant impact on the Net Working Capital Ratio

H14: AI has a positive and significant impact on the asset portfolio

H2: AI has a positive and significant impact on the bank's profitability.

H21: AI has a positive and significant impact on return on assets (ROA)

H22: AI has a positive and significant impact on return on equity (ROE)

H23: AI has a positive and significant impact on Net Interest Margin (NIM)

H24: AI has a positive and significant impact on Non-Interest Income to Total Income

3- Methodology:

The main objective of this study is to explore the effect of artificial intelligence on financial performance in the banking sector in Egypt. To achieve the main objective and subobjectives of this study, the authors have adopted the quantitative approach.

The study sample consists of 16 banks operating in Egypt during the period from 2018 to 2024, resulting in a total of 112 observations. The sample is selected depending on the availability of information related to AI and digitalization. The sample includes the following banks (National Bank of Egypt, Banque Misr, Banque du Caire, Housing and Development Bank, Export Development Bank, Abu Dhabi Islamic Bank, Credit Agricole Egypt, Al Baraka Bank of Egypt, Commercial International Bank, Egyptian Gulf Bank, Faisal Islamic Bank of Egypt, Qatar National Bank of Egypt, Suez Canal Bank, Arab Investment Bank, Al Ahli Bank of Kuwait Egypt, and Arab Banking Corporation Egypt).

The artificial intelligence (AI) is the independent variable and is measured by calculating the ratio (value of technological assets to total assets) (Manukyan and Parsyan,2024). Technological assets include the cost of purchasing AI-enabled software or systems, the cost of developing internal systems, and the cost of equipment and technologies that support AI operations.

The dependent variable is the financial performance. Financial performance analysis includes two essential elements: liquidity and profitability ratios (Putri et al 2024; Hasidi et al., 2024). The ability of the business to fulfill its short-term obligations is gauged by the liquidity ratio (Nadila et al., 2024; Wibowo et al., 2024), and the ability of a business to turn a profit in relation to its revenue, assets, and equity is the main emphasis of profitability ratios (Safitri 2018; Tutcu et al., 2024). These financial ratios offer comprehensive information on the business's financial performance, hence its financial health (Nurhaliza and Harmain, 2022; Hasidi et al., 2024).

Liquidity ratios:	Profitability ratios:
• Loan-to-Deposit Ratio: The loan-to-deposit ratio (LDR) • Cash and Cash Equivalents to Total Assets (CASHT): Shows the proportion of highly liquid assets the bank holds. • Net Working Capital Ratio (NWCR): It is calculated by dividing its current assets by its current liabilities. • Analysis of Asset Portfolio (non-performing loans – NPL)	• Return on Assets (ROA): Formula: Net Income / Total Assets • Return on Equity (ROE): Formula: Net Income / Shareholders' Equity • Net Interest Margin (NIM): (Interest Income - Interest Expense) / Average Earning Assets. And Average earning assets = (Assets at the beginning of the year + Assets at the end of the year) / 2. • Non-Interest Income to Total Income (NIITI): Non-Interest Income / Total Income

The study relied on path analysis methodology using Smart-PLS v4 to examine the causal relationships between the artificial intelligence (AI) variable and the liquidity and profitability variables, including sub-indices for each. The model was evaluated using multiple metrics such as the variance inflation

factor (VIF), model fit indices (SRMR, NFI, Chi-square), and the heterotrait-monotrait ratio (HTMT) to ensure the validity and reliability of the results. Stata v4 was also used to conduct a descriptive analysis of the study variables.

4- Results and Discussion:

4.1 descriptive analysis:

The analysis results in table (1) show that the Artificial Intelligence (AI) variable in banks has an average value of 0.0408, with a standard deviation of 0.216. This indicates that banks have varying proportions of technology assets compared to total assets. Although the minimum value was -1.6716, which may reflect exceptional cases where technology assets are lower than expected, the maximum value of 0.8830 indicates that some banks have a high proportion of technology assets.

Table (1) Descriptive analysis of study variables

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. summarize AI LDR CASHT NWCR NPL ROA ROE NIM NIITI
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Variable	Obs	Mean	Std. Dev.	Min	Max
AI	112	.0407889	.2164397	-1.671638	.8830404
LDR	112	.4822768	.3373613	.102603	3.658891
CASHT	112	.0790671	.0404252	.0000731	.3646216
NWCR	112	.990575	.0787176	.7366012	1.271502
NPL	112	.3631752	1.798196	.0004149	15.87268
ROA	112	.0256075	.0137167	-.0103777	.0656744
ROE	112	.273532	.1091275	-.0967672	.5350016
NIM	112	.0288847	.0155399	-.0116243	.0752925
NIITI	112	.6049875	3.303904	.0774291	35.2458

Source: from Stata output V14.

Examining the loan-to-deposit ratio (LDR), we find that the average is estimated at 0.4823, with a standard deviation of 0.337. This indicates that the banks in the study tend to maintain a reasonable balance between loans and deposits. The maximum value, which reached 3.6589, indicates that some banks may face high financing risks, which warrants further monitoring in this area. The minimum value, which reached 0.1026, indicates that some banks rely more on funding sources that are less dependent on deposits.

Cash and cash equivalents to total assets (CASHT) ratio averaged 0.0791 with a standard deviation of 0.0404. This result indicates

that the liquidity available to banks in general is not exceptionally high. However, some banks maintain a high liquidity ratio relative to total assets, as evidenced by the maximum value of 0.3646, while the minimum value was 0.0007. This may indicate that some banks rely less on cash and cash equivalents.

Also, the results showed that the net working capital ratio (NWCR) of banks ranged between 0.7366 and 1.2715, with an average of 0.9906 and a standard deviation of 0.0787. This result indicates that most banks have a good capacity to cover their short-term liabilities. Despite some variations, this ratio represents a positive indicator of the soundness of banks' financial position.

Likewise, Non-performing loans (NPL) are one of the most important indicators in bank financial analysis. The NPL recorded a mean of 0.3632 with a standard deviation of 1.7982. The maximum value of 15.8727 indicates that some banks face significant challenges in managing non-performing loans. Although the mean of 0.3632 reflects a moderate incidence of non-performing loans, this large discrepancy between the minimum and maximum values warrants special attention to improve risk management.

Also, the results showed that the Return on assets (ROA) reflects banks' ability to generate profits from their assets, with a mean of

0.0256 with a standard deviation of 0.0137. The maximum value of 0.0657 indicates that some banks are generating good returns, while the minimum value of -0.0104 indicates that some banks may be facing difficulties generating profits. Based on these results, it can be observed that returns on assets vary significantly among the banks in the sample.

And, return on equity (ROE) is an important measure of bank profitability, with an average of 0.2735 and a standard deviation of 0.1091. The maximum value of 0.5350 indicates that some banks are performing well in generating profits for their shareholders, while the minimum value of -0.0967 may indicate that some banks are experiencing low returns on equity.

Then, net interest margin (NIM) showed an average of 0.0289 with a standard deviation of 0.0155. The maximum value of 0.0753 indicates that some banks are achieving high interest margins, reflecting their ability to generate interest income efficiently. The minimum value of -0.0116 indicates that some banks may be facing challenges in this area.

Also, the non-interest income to total income (NIITI) ratio recorded an average of 0.6049 with a standard deviation of 3.3039. The maximum value of 35.2458 also shows that some banks rely heavily on non-interest income sources. This suggests that some banks may be less dependent on traditional interest income, making them less vulnerable to interest rate fluctuations.

Based on the descriptive results, it can be concluded that the banks in the sample enjoy a degree of diversity in financial performance, with some banks demonstrating excellent performance in areas such as liquidity and profitability, while others face challenges in managing non-performing loans and generating returns. The extreme values in several variables also indicate some significant differences among banks in how they handle financial risks and implement their strategies.

4.2 Evaluating the results of path analysis models:

The variance inflation factor (VIF) is used to assess multicollinearity among variables in an analysis model. If the VIF value is greater than 10, it may indicate strong overlap between variables, which can negatively impact the accuracy of estimates in statistical models.

Table (2) Variance inflation factor Results

Model 1	VIF	Model 2	VIF
AI	1.000	AI	1.000
CASHT	3.667	NIITI	1.016
LDR	1.031	NIM	0.422
NPL	1.875	ROA	1.105
NWCR	2.359	ROE	2.658

Source: from Smart-Pls v4 output.

The results of the variance inflation factor (VIF) for the first model indicate that the overlap between the variables is generally weak to moderate, ensuring the accuracy of the model's estimates. For the artificial intelligence (AI) variable, the VIF recorded a value of 1.000, indicating no overlap with the other variables, which is ideal. For the cash and equivalents to total assets (CASHT) ratio, the VIF recorded a value of 3.667, indicating moderate overlap with the other variables, but still well below the critical value of 10. For the loan-to-deposit ratio (LDR), the VIF value was 1.031, indicating little overlap. For nonperforming loans (NPL), the VIF recorded a value of 1.875, indicating weak overlap that does not affect the results. For the net working capital ratio (NWCR), the VIF recorded a value of 2.359, indicating moderate overlap but with no negative impact on the accuracy of the estimates.

In the second model, the VIF results showed that artificial intelligence (AI) recorded a VIF of 1.000, indicating no overlap with the other variables in the model. For non-interest income to total income (NIITI), the VIF was 1.016, indicating very little overlap with the other variables. For net interest margin (NIM), the VIF was 0.422, indicating little overlap with the other variables. However, return on assets (ROA) recorded a VIF of 1.105, indicating no collinearity, but potentially affecting the accuracy of the model's estimates. Finally, return on equity

(ROE) recorded a VIF of 2.658, reflecting weak to moderate overlap that did not affect the results.

Based on the VIF results in both models, it can be argued that the overlap between variables does not pose a significant problem affecting the accuracy of the estimates. After checking the variance inflation factor, the following table shows the Model fit Result.

Table (3) Model fit Result Model 1 SRMR 0.017 Model 2

	Model 1	Model 2
SRMR	0.017	0.038
d_ULS	0.046	0.022
d_G	0.055	0.031
Chi-square	2.803	3.922
NFI	0.929	0.940

Source: from Smart-Pls v4 output.

The SRMR results are a strong indicator of model fit. The first model scored 0.017, which is below the acceptable threshold of 0.08, indicating a very good fit between the model and the data. The second model scored 0.038, also below 0.08, indicating that the second model fits the data well. Overall, both models demonstrate excellent fit by this measure.

The d_ULS results also showed that the first model scored 0.046, while the second model scored 0.022. The d_ULS value indicates the degree of variation between the predicted and actual matrices,

and the smaller the value, the better the model fits. Therefore, the second model performed better than the first on this metric.

The Chi-square value is a common test for assessing a model's fit to the actual data. The first model scored 2.803, while the second model scored 3.922. Lower values indicate a better fit. The NFI results showed that the first model scored 0.929, while the second model scored 0.940. An NFI close to 1 indicates a good fit. Based on these results, it can be said that the models demonstrate a better fit to the data. The next table shows Heterotrait-monotrait ratio (HTMT).

Table (4) Heterotrait-monotrait ratio (HTMT)

Model		Heterotrait-monotrait ratio (HTMT)
1	Liquidity <-> AI	0.070
2	Profitability <-> AI	0.223

Source: from Smart-Pls v4 output.

The Heterotrait-Monotrait Ratio (HTMT) was used to assess the interaction between the different variables in the model. This measure compares the correlations between different variables (heterotrait) with the correlations between the same variable (monotrait), assessing the extent of the interaction between variables.

The results in Table 4 indicate that the relationship between liquidity and AI is very weak, with a value of 0.070 being

significantly low, meaning that AI does not significantly interfere with liquidity. This indicates good discrimination between the two variables in the model.

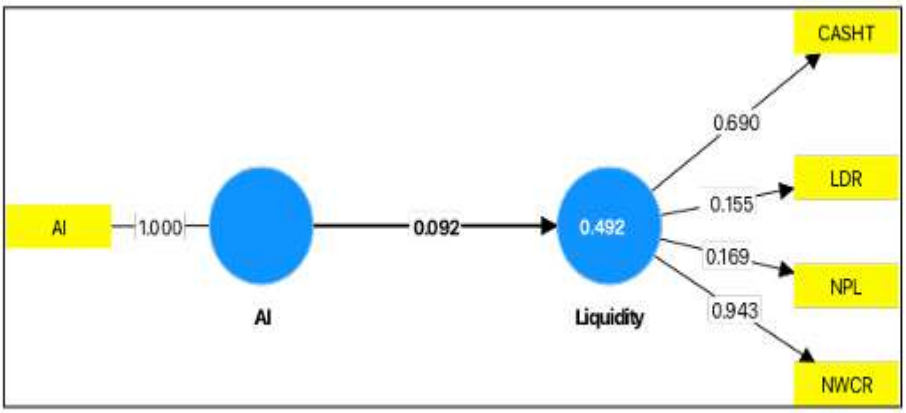
In the second model, the value of 0.223 indicates that the relationship between profitability and AI is greater than the relationship between liquidity and AI in the first model, but it is still a low value compared to the accepted threshold of 0.85 or 0.90 that is typically used to identify significant overlap between variables.

After verifying the stability of the path analysis results for the study models, we next discuss the results of the hypotheses of the study.

4.3 Discussion first hypothesis results:

To test the study's first hypothesis, which states that:
H1: AI has a positive and significant impact on the bank's liquidity.
Path analysis was used, and the results came out as shown in the following figure:

Figure (1) Path Analysis for Model 1



Source: from Smart-Pls v4 output.

Figure 1 shows that the value of the explanation coefficient reached 0.492, which indicates that artificial intelligence explains 49.2% of the change in the liquidity indicators of the banks under study, where the percentage of the explanation coefficient is greater than 30%, which is acceptable. As for the rest of the percentage of the explanation coefficient, it is due to other factors that were not included in the study model. The following are the results of the table of parameters of the study model and the values of outer loadings.

Table (5) Path analysis parameters result for the first model

	Coff.	T statistics	P values
AI -> Liquidity	0.092	5.457	0.000
Outer loadings			
CASHT <- Liquidity	0.690	5.717	0.000
LDR <- Liquidity	0.155	4.339	0.000
NPL <- Liquidity	0.169	4.735	0.000
NWCR <- Liquidity	0.943	5.550	0.000

Source: from Smart-Pls v4 output.

The results of the path analysis indicate a statistically significant positive relationship between the artificial intelligence (AI) variable and the liquidity variable. The path coefficient reached 0.092, with a high t-value of 5.457 and a p-value less than 0.001. This indicates that increased investment in technological assets (represented by AI) contributes to improving liquidity levels in banks. This result can be explained by the ability of AI technologies to improve the efficiency of cash flow management, reduce operating costs, and enhance financial forecasting processes, which positively impact liquidity.

Regarding the relationship between liquidity and its sub-indices, the results showed that the net working capital ratio (NWCR) is the most robust indicator of liquidity, recording the highest path coefficient of 0.943, with high statistical significance ($T = 5.550$, $P < 0.001$). This is consistent with the financial literature, which emphasizes the importance of working capital as a key

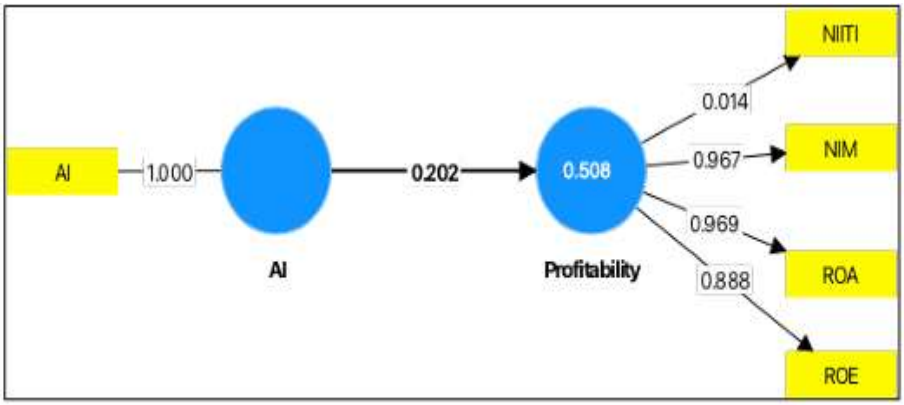
determinant of the liquidity. The cash and cash equivalents to total assets (CASHT) variable also showed a strong impact on liquidity, with a path coefficient of 0.690, reflecting the role of direct cash liquidity in enhancing financial resilience.

On the other hand, the relationship between liquidity and both the loan-to-deposit ratio (LDR) and non-performing loans (NPL) was less strong compared to previous indicators, with path coefficients of 0.155 and 0.169, respectively. However, both relationships were statistically significant ($P < 0.001$). It is worth noting that the positive impact of liquidity on non-performing loans (NPL) contradicts theoretical expectations, as higher liquidity is assumed to lead to lower credit risk. This result may be explained by the fact that banks with higher liquidity may adopt more aggressive lending policies, which increases the likelihood of default. Further research is needed to examine the mechanisms of this relationship.

4.4 Discussion Second hypothesis results:

To test the study's second hypothesis, which states that:
H2: AI has a positive and significant impact on the bank's profitability.
Path analysis was used, and the results came out as shown in the following figure.

Figure (2) Path Analysis for Model 1



Source: from Smart-Pls v4 output.

Figure (2) shows that the value of the explanation coefficient reached 0.508, which indicates that artificial intelligence explains 50.8% of the change in the profitability indicators of the banks under study, as the percentage of the explanation coefficient is greater than 30%, which is acceptable. As for the rest of the percentage of the explanation coefficient, it is due to other factors that were not included in the study model. The following are the results of the table of parameters of the study model and the values of outer loadings:

Table (6) Path analysis parameters result for the second model.

	Coff.	T statistics	P values
AI -> Profitability	0.202	5.003	0.000
Outer loadings			
NIITI <- Profitability	0.014	4.829	0.000
NIM <- Profitability	0.967	3.412	0.001
ROA <- Profitability	0.969	3.404	0.001
ROE <- Profitability	0.888	3.284	0.001

Source: from Smart-Pls v4 output.

The results of the path analysis of the relationship between artificial intelligence (AI) and profitability revealed a strong and statistically significant positive effect, with a path coefficient of 0.202, a high t-statistic (5.003), and a p-value of less than 0.001. This demonstrates that investment in technology assets (AI) contributes significantly to enhancing the profitability of banks. This result can be explained by AI's ability to improve operational efficiency, reduce costs, and increase revenues through big data analysis and the provision of innovative financial solutions.

As for the relationship between profitability and its sub-indices, the results showed that return on assets (ROA) and net interest margin (NIM) were the two most influential indicators in measuring profitability, recording high path coefficients of 0.969 and 0.967, respectively, with high statistical significance (P <

0.01). This reflects the importance of efficient asset management and achieving higher interest margins in enhancing profitability. Return on equity (ROE) also showed a strong impact, with a path coefficient of 0.888, highlighting the role of equity financing in achieving higher financial returns.

On the other hand, the impact of non-interest income to total income (NIITI) on profitability was relatively weak compared to other indicators, with a path coefficient of 0.014, although it was statistically significant ($P < 0.001$). This indicates that non-interest income plays a limited role in improving profitability compared to core income generated from interest and core operating activities.

5- Conclusion:

The main objective of this study is to explore how artificial intelligence affects on the financial performance in Egyptian banks. According to the descriptive analysis, the financial performance of the banks in the sample varies to some extent; some do exceptionally well in both liquidity and profitability, while others struggle to manage non-performing loans and produce returns. Extreme levels in several variables also point to some notable variations in the ways that banks manage financial risks and carry out their plans.

The results of the path analysis showed a statistically significant positive relationship between artificial intelligence (AI) and bank liquidity, with a path coefficient of 0.092, a high t-statistic value of 5.457, and a p-value of less than 0.001. This indicates that increased investment in AI technologies contributes to improving banks' liquidity levels. This result can be explained by AI's ability to improve the efficiency of cash flow management, reduce operating costs, and enhance financial forecasting processes.

Likewise, the results showed a statistically significant positive relationship between artificial intelligence (AI) and bank profitability, with a path coefficient of 0.202, a high t-statistic value of 5.003, and a p-value of less than 0.001. This indicates that investment in AI technologies leads to improved banks' profitability. This result illustrates that AI's ability can improve operational efficiency, reduce costs, and increase revenues.

This study provides strong evidence of the tangible benefits of banks' investment in AI technologies, both in terms of improving liquidity and enhancing profitability. These findings constitute a valuable addition to the literature on the effect of AI on financial performance in the banking sector and open up fresh opportunities for this area's future research.

The results emphasize how crucial it is for banks to implement AI technologies and invest in AI expertise to enhance their

financial performance as well as financial outcomes. These results encourage banks to improve their practices and activities related to AI to provide successful outcomes.

Limitations and Recommendations for Future Research:

Recognizing the limitations imposed on this research is important. Because the research was conducted in the banking sector in Egypt, over at a specified period of time. Then, the future research may explore the same relationship in other industries with different cultures. Besides, using artificial intelligence successfully requires encouraging research about regulatory compliance and ethical considerations.

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