Artificial Intelligence (AI) Applications on the Banking Sector: Case Study of Egypt with Special Emphasis on Sustainable Development

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Abstract

The Egyptian banking sector witnessed huge technological advancement over the recent years. Since then, all banking transactions are done via internet banking, online banking, mobile applications, ATM machines, and electronic branches.

The Egyptian banking sectors is composed of 39 banks. Each bank has a huge widespread branch inside and outside Egypt. Some Egyptian banks established subsidiaries in European, African, Asian, and Arab countries.

The use of the AI in the banking solutions became a normal day-to-day practice in Egyptian banks. AI applications based on various algorithms and machine learning tools are used by all banks in Egypt.

This applies to both commercial, and investment banks in Egypt, which give rise to the development of research and development (R&D) in Egyptian banks, matched with outsourcing of such R&D services in some cases.

Purpose: This research paper attempts to study the relationship between AI and the development of the banking sector to support the economic growth in Egypt, with special consideration to financing the green economy.

Design/methodology/approach: This paper focuses on studying the impact of using the AI to enhance the banking services, and to minimize the banking risks in Egypt. The banking sector is crucial in transferring funds from savers to investors to finance projects, as part of the development process in Egypt, as a requirement for economic growth in Egypt.

Findings: the analysis and results underlined the followings:

1. The AI support to the advancement of the banking services in general.
2. The services are supported by the AI in the banking sector in Egypt.

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3. The benefits of utilizing the AI in the banking sector in Egypt.
4. The relation between utilizing the AI in the banking sector and the green economic growth in Egypt.

The original/value of the chapter: It made recommendations and draw policies that can enhance the efficient utilization of the AI to better serve the banking sector in Egypt.

1. Introduction

The banking sector is divided into two main types of banks based on their functions. These are the commercial banks, and the investment banks. The commercial banks are the most common type of banks in Egypt. Commercial banks mainly receive deposits and provide loans, together with a package of other related services, including the letter of credits (LCs), and the letter of guarantees (LGs).

The investment banks are banks that mainly works on portfolio management, underwriting, and mergers and acquisitions (M&A).

In Egypt, there are some major banks that practice global banking by combining both commercial banking activities, and investment banking activities, such the National Bank of Egypt (NBE). NBE is biggest bank in Egypt.

This research paper encompasses several aspects of AI uses in the banking sector, with special emphasis on Egypt. The uses of AI by banks escalated the completion among banks, with the intention to provide unique services to the banks' customers.

The new trend in the banking sector in Egypt is to finance projects that adopt technology and production methods that support the green economy within the sustainable development framework.

Egypt's Sustainable Development Strategy 2030 calls for financing small and medium enterprises (SMEs), especially these enterprises that support the green economy. Special financial facilities are given to projects that uses renewable energy sources.

This paper will be divided as follows: Section one in which the introduction has been tackled. Section two includes literature review. Section three includes an overview of the AI uses in the banking sector, especially in Egypt. Section four will tackle the econometric analysis of the relationship between the use of AI in the banking sector in Egypt and the economic growth in Egypt by using a time series analysis. Section five includes the conclusion, the findings, and the recommendations.

2. Literature Review

OECD (2024) analyzed the use of AI in financial services as related to advanced visualizations, machine learning models, and entity recognition. These new applications provided comparative advantage to financial institutions. This new trend brought financial stability, and creditworthiness to SMEs clients with short credit history. This was reflected in diminishing the pro-cyclicality of the systemic risk of the SMEs. Also, the AI innovation reduced the vulnerabilities related to the autonomy, and the complexity of the dynamic adaptability of the diversified huge financial data of the banks' clients. Also, the advancement in the AI financial applications enhanced the financial security requirements by integrating the AI to the Blockchain-based financial products by using biometrics for AI identification and recognition.

Marco (2024) studied a variety of developing and developed countries applying different AI financial applications. The study concluded that the levels of applications were diversified among these countries and ranged between predictive-forecasting systems, classification-detection-early warning systems, and big data analytics-data mining -text mining systems.

Arianna (2023) studied the socio-economic impact of using AI in migrating financial data as related the development and diffusion of the pervasiveness, dynamism and complementarity by using the general-purpose technologies (GPTs).

This in-depth examination of the technologies related to the financial Industry 4.0 paradigm. The migration of the financial data is connected to other AI applications that deals with big data, cloud, and robotic repetitive solutions.

Carl (2024) verified that AI can invent risk models to encounter financial risks related to granting banking credits and investment portfolios. AI using machine learning can correlate data to formulate financial risk forecasts. According to this study, it was proved that through machine learning, and algorithms it was possible to attain of cost saving in dealing with the financial data by the European banks.
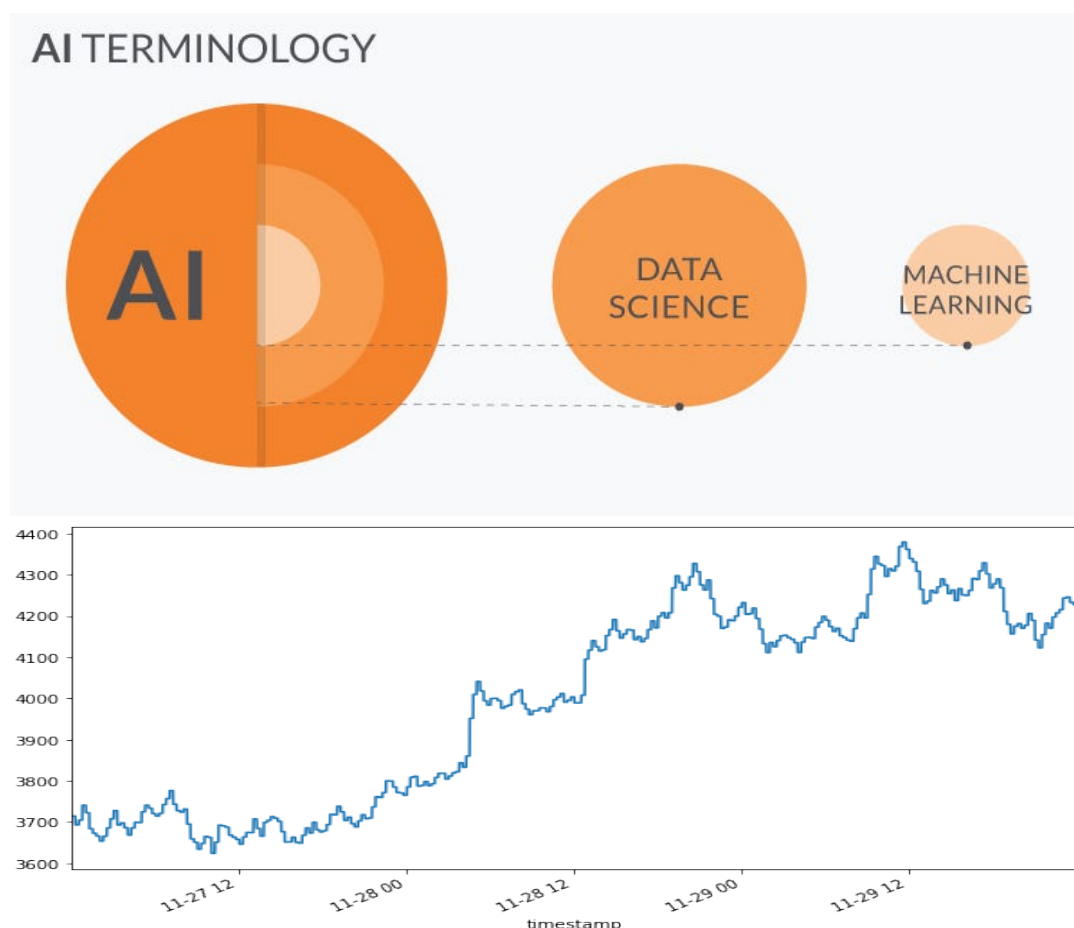
Yves (2024) shows the importance of merging finance and data science applications. Accordingly, he explored the adoption of AI and machine deep learning algorithms to discover statistical inefficiencies in financial data. AI's sophisticated algorithms can analyze real time transactions to detect patterns and/or real time anomalies indicating fraudulent banking activities.

Marcos (2024) concentrated on Machine learning (ML) algorithms tasks that can structure Big data that can use supercomputing methods to backtest financial data by avoiding false positives. He underlined the new trend in coding by being produced jointly by emerging efforts of financial experts and portfolio managers in one hand, and data scientists in the other hand. Predictive Analytics and Forecasting using historical data combined with mathematical and statistical models already improved financial risk forecasting in the banking sector worldwide. The methods applied are based on leveraging data analytics to enhance algorithmic risk assessment, and personalized banks client's transactions by determining the possibility of fraudulent activities to detect financial crimes.

Przemek (2023) find out that the use of AI in the financial sector has several embedded impacts.

Such impacts that exceed the direct financial impacts, and extends to social, economic and political impacts. The accuracy and security of the financial data promotes the businesses and the economies. It also provides for a resulted political stability. Accordingly, the investment on financial technology has a wide return on the society. He introduced another point of view related to risk assessment ability. The flow of investment depends heavily on the reputation of the financial entity and the receiving country. This is ultimately depending heavily on both the financial entity and the country abilities to detect and to address anomalies of abnormal data patterns as part of the financial risk defense efforts. This also requires continuous efforts to minimize any system flaws.

Sofien (2024) focused on analyzing the sophisticated deep learning financial and banking models using Python to create and backtest financial and banking transactions algorithms using normal machine learning and reinforcement machine learning. Sofien Kaabar as a Fintech financial author, and financial consultant introduced new deep learning algorithm optimization methods that encompass technical and quantitative analyses by using time series data to establish evaluation metrics. This was done by using Python to incorporate technical indicators with optimized Machine Learning (ML) models.

Deepak (2023) verified the importance of using Python in the probabilistic machine learning (PML) applied on small and noisy financial datasets used to adapt with probabilistic retrodiction, and counterfactual analysis. PML also enables systematically encoding of personal, and institutional financial data to be included in the normal commonly used financial ML models and applications. Deepak used several figures to express these logical flows as follows:

3. An Overview of the AI Uses in the Banking Sector, Especially in Egypt

The AI Support for the Advancement of the Banking Services in General

AI using machine learning techniques developed new applications related to banking credits and the minimization of the financial risk. AI works on fighting fraud detection by identifying anomalous financial data and activities.
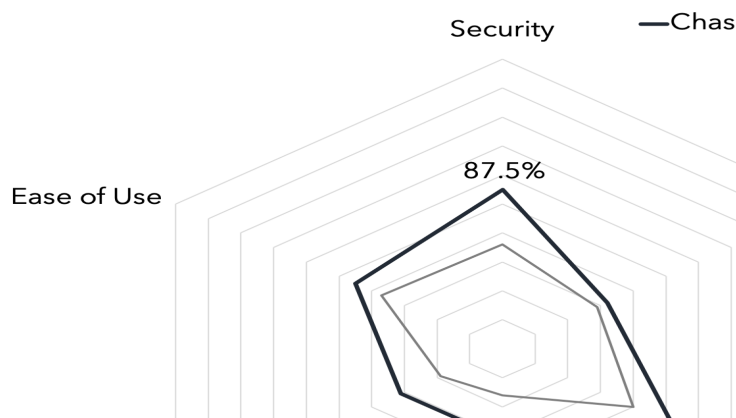
In the USA, the Bank Administration Institute-BAI (2024) provided an integrated analysis of the AI uses in the US banking sector. Fintech industry became a top priority. US banks attained aggregate direct cost savings generated from using AI that reached USD 447 billion in 2023, in addition to additional indirect cost savings. AI secures banks customers' accounts by detecting and isolating irregularities in patterns to prevent fraud and cyberattacks. This resulted in avoiding online payment fraud losses of USD 48 billion in 2023.

US banks adopt AI deep learning technology in office applications to verify customers' data to detect money laundering with double the efficiency.

US financial institution recently use multilingual chatbots empowered by FinChat AI using ChatGPT to provide financial solutions for wealth management customers. Also, this new banking system is still capable of detecting any abnormalities to alert customers against possible risks or fraud transactions.

J.P. Morgan Chase's Data Centers adopt AI payment validation screening automated methods to screen customers' data and to rum simultaneous financial analysis for each transaction to revalidate each client financial position simultaneously. These updated positions are automatically notified to the management and the bank customers. This qualified J.P. Morgan Chase to obtain the Insider Intelligence's 2023 US Banking Digital AI Trust Survey Award.

Services Supported by the AI in the Banking Sector in Egypt

The Central Bank of Egypt (2024) governs the banking sector in Egypt, and it provides all data related to the banking sector and the use of the AI in the banking sector in Egypt. The Egyptian banking sectors is composed of 39 banks. Each bank has a huge widespread branches inside and outside Egypt. Some Egyptian banks established subsidiaries in European, African, Asian, and Arab countries.

The investment on financial technology has a wide return on the Egyptian society. The Financial Inclusion Strategy (2022-2025) has included most of the Egyptian population in the spread of the banking services. The pensions systems in Egypt necessitated the use of debit cards to receive the monthly pensions by the retired people and by their families. During the COVID-19 pandemic, the Egyptian government provided financial vulnerable population who lost their jobs with

emergency pensions by free-of-charge debit cards only. This increased the number of the customers of the bank serving an Egyptians with a population of almost 105 million citizens, in addition to a very big business sector. The banking sector is still serving the government institutions.

According to the Central Bank of Egypt (2024), the total time deposits in the Egyptian banks increased from EGP 8.58 trillion in 31/12/2022 to EGP 10.17 trillion in 31/12/2023. This means the total time deposits in the Egyptian banks raised by EGP 1.59 trillion in one year only with a growth rate of 18.5 percent in last year. This reflects the strong demand on the banking services by the banks' clients in Egypt.

The use of the AI in the banking solutions became a normal day-to-day practice in Egyptian banks. AI applications based on various algorithms and machine learning tools are used by all banks in Egypt.

Egypt Artificial Intelligence Market

Huge market opportunity due to growing need for system integration

FIRE ALARM SYSTEM

Clients Potential
Smart Systems

Client Focus
Fire Alarm Systems,
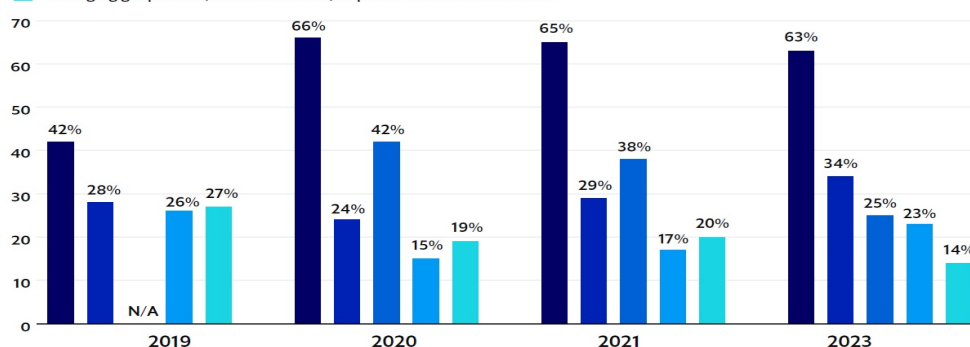Access Control Systems,
Audio/Visual Systems

This expansion in the FinTech banking sector in Egypt was matched by the advancement in the banking services provided to the customers, and to the high degree of related security to protect banks' clients against

Evolution of FinTech-Enabled Startups over Years

New Startups

fraud.

Which trends do you believe will have the biggest impact on banks in the next five years?

- New technologies (e.g., generative AI, blockchain, quantum computing, cloud computing, VR/AR, APIs, IoT, biometrics etc.)
- Changing customer behaviour and demands for new banking products and services
- Regulation on digital and cloud technology
- Changing competitive environment
- Changing geopolitical, macroeconomic, or public health environment

This necessitates the need for the heavy use of the AI to deal with the workflows of huge volumes of transactions and payments, which included the automated amalgamation of the Natural Language Processing (NLP) and the Optical Character Recognition (OCR), especially in data validation processes.

The Egyptian banking sector is utilizing the AI applications to deal with huge volumes of real-time data generated from various diversified sources, by optimizing machine learning techniques that can also diminish risk without interrupting investments plans.

The Benefits of Utilizing the AI in the Banking Sector in Egypt

The benefits of utilizing the AI in the banking sector in Egypt are numerous. This research paper explored in the previous sections some of these benefits as related to the advancement in providing the banking services, and as related to the security issue.

The AI systems can maximize banks' profitability by analyzing income, expenses, and investments, while preserving the banks' expansion plans to encounter competitions. Thus, Egyptian banks expanded not only by branching-out, but also by rendering full comprehensive 24/7 remote services to keep their market shares and to attract new clients as well. The fully automated execution and trading was extended regionally as well. All this helped in providing Egyptian banks with direct benefits, in addition to indirect benefits.

Accordingly, the investment of the Egyptian banks in the AI services and applications boosted their clients-base, and hence their profitability.

On the other hand, the investment of the Egyptian banks in the AI services participated in the regional rank of Egypt as investor in AI as a percentage of the total GDP, as follows:
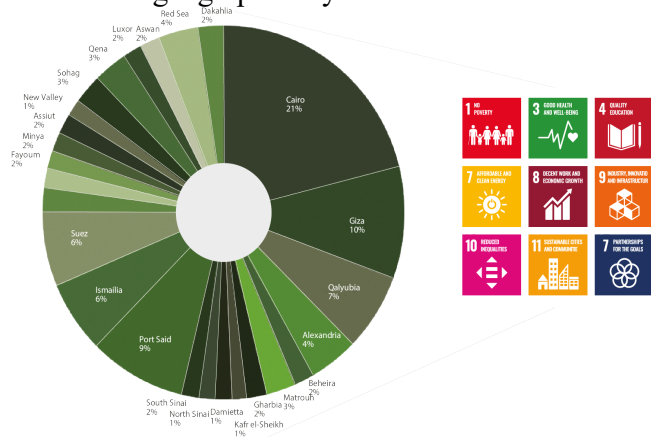
Contribution of AI to GDP by MENA Countries | 2030

The Relation Between Utilizing the AI in the Banking Sector and the Green Economic Growth in Egypt

Egypt's Sustainable Development Strategy 2030 calls for financing small and medium enterprises (SMEs), especially these enterprises that support the green economy. Special financial facilities are given to projects that uses renewable energy sources.

This fact is shown in the following figure as being distributed geographically as follows:

SMEs in Egypt enjoy soft loans, with low and interest rate and a grace period. This may differ according to the size, and the type of activities as related to the requirements of the Sustainable Development Strategy 2030.

This new diversified trend necessitated the use of the AI in calculating and evaluating the financial position of the clients. This is done at the stage of the credit study, and during the life time of the company.

4. The Econometric Analysis of the Relationship Between the Use of AI in the Banking Sector in Egypt and the Economic Growth in Egypt by Using a Time Series Analysis

Data Analysis

Data collected dealt with economic growth given by GDP growth, against the AI Spending (AIS) in the Banking sector.

$$Y = \beta° + \beta1\ AIS + \mu$$

The annual GDP growth is the dependent variable while the rest of the variables are explanatory variables. The main explanatory variable is the AI spending in the Banking sector and other variables are used as stochastic error term.

Y	GDP growth (Annual %)
AIS	The AI spending in the Banking sector

The relations are tested by Auto-Regressive Distributive Lag model.

- **Unit root test**

Before running the model, Unit root test is applied to ensure that all the variables are either I(0) and I(1) in order to avoid spurious regression.

Variable	Prob.*	
	At level	1st difference
GDP growth	0.00375	0.0000
AIS	0.813	0.0000

ARDL Model

Included observations: 45 after adjustments

Maximum dependent lags: 3(Automatic selection)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDP_GROWTH(-1)	0.007251	0.871924	0.045326	0.7952
AIS	0.002634	0.007615	0.743581	0.7766
R-squared	0.432891	Mean dependent var		3.195401

Test Statistic	Value	k
F-statistic	0.475168	3.5

This is a case of positive correlation. In the long run the AI spending on the banking sector proved to have a significant positive effect on the economic growth in Egypt matching with the economic theory that the advancement and the long-run cost savings in the banking sector will ultimately lead to accelerate economic growth.

4.   Conclusion,   Findings,   and Recommendations

Moving from conventional banking services to advanced banking services necessitated the use of AI algorithms in banking services worldwide and in the USA and Egypt as explored in this study. This lead to lower risk, but with even higher returns by applying axiomatic statistical methodologies to a flow of banking data that requires verifications, inferences and predictions within a dynamic and changeable banking market environment.

Furthermore, probabilistic financial ML systems tackles uncertainties and errors of financial and banking systems as features, not bugs, by providing a corrective path to mitigate and eliminate them, as part of a successful realistic decision-making process and risk management approach.

The followings are few recommendations made to Egypt to heavily utilize the AI in the banking sector:

1- To include the FinTech and the AI financial applications in the education curriculum in the high schools and in the universities.
2- To encourage banks to allocate more funds on advertisements to explain to their customers the new FinTech products that are using AI applications.
3- To adopt financial incentives to encourage banks to be always updated with new innovations.
4- To provide tax incentives and custom duties exemptions for the importation of computers and mobile phones as well as expanding producing them locally to support the use of the banks' services based on the AI financial applications.
5- To benefit from the machine learning techniques to promote and develop new AI financial applications in Egypt.

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