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Abstract

Purpose: The aim of the study was to highlight impact of using mobile payment systems as an artificial intelligence tool on enhancing banking efficiency amidst the rapid technological advancements in the banking sector.

Methodology: The study hypothesized that the use and application of mobile payment systems contribute to enhancing banking efficiency by influencing efficiency indicators, including profitability, productivity, and financial intermediation.

Findings: The research's significance stems from the increasing importance of electronic payment systems and their effective role in developing and enhancing the efficiency of the banking sector. The research also contributes to clarifying the role of modern systems in facilitating banking transactions and reducing reliance on traditional methods, leading to cost reductions and saving time and effort. This, in turn, enhances the quality of banking services and increases customer satisfaction.

Unique Contribution to Theory, Practice and Policy: The study concluded with a number of findings, most notably the positive impact of mobile payment systems on improving operational efficiency and bank profitability. Electronic payments have contributed to improved profitability indicators, increased productivity, and enhanced financial intermediation, positively impacting the overall efficiency of banks.

Keywords: *Mobile Payment, Banking Efficiency, Profitability, Productivity, Financial Intermediation*

JEL Codes: *G53, G21, L25, M41*

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INTRODUCTION

The world is witnessing a radical transformation in many areas thanks to the use of information and communication technologies. This scientific progress in the field of information and communication has added new dimensions to the banking sector, providing modern and advanced means for transferring funds, thus facilitating and accelerating transactions in the electronic environment. Electronic payment systems have become one of the most important components of the banking infrastructure (Kana, 2:2022). Electronic payment systems allow bank customers to conduct various banking transactions, from withdrawing cash to paying for services. These systems enable fast and secure transactions, which encourages electronic transactions that do not require personal attendance or the use of paper money (Sultani, 2021, 2021). Hence, the importance of employing mobile electronic payment systems in enhancing banking efficiency is highlighted through a set of indicators during the period (2018-2024).

LITERATURE REVIEW

Concept of a Mobile Electronic Payment System

The rapid development and widespread adoption of technology have led to a significant increase in smartphone sales, making them an integral part of daily life. Consequently, banks have migrated their electronic banking applications to their customers' smartphones. Mobile electronic payment can be defined as an interaction that connects the customer with the bank via a mobile device such as a smartphone or digital assistant. This payment process is used in almost all banking transactions, except those requiring more detailed information (Al-Tamimi, 2022:53). It is a specific form of electronic payment that utilizes communication technology, enabling mobile users to make payments using their internet-connected devices. Mobile electronic payment encompasses products, services, and invoices that rely on mobile devices and allows users to easily utilize wireless infrastructure and communication technologies (Chang et al., 2023:419). It is a system that operates on smartphones and tablets, facilitating easy banking transactions and reducing the need to carry and use cash (Neelam & Bhattacharya, 2023:10). It is the process of transferring or receiving money, or making payments via mobile phone, and this can be done through a digital wallet stored on the device or via mobile applications linked to bank accounts or cards (Allal and Tariq, 2025:240).

Advantages of Mobile Payment:

- Ease of Use: All mobile payment systems share a common feature: a high level of ease of use, including money transfers and payments. This ease of use is one of the main factors that has made mobile payments so popular.
- Integration: Mobile applications are evolving rapidly and are no longer just financial tools. These services can transform the mobile phone into a comprehensive business tool, replacing banks, ATMs, and credit cards by enabling users to conduct transactions via their mobile devices.
- Cost Savings: Cost is a major factor in the rapid spread of mobile payment systems, and this cost reduction is a key factor in increasing consumer adoption of these systems.
- Security: Mobile payment systems enhance transaction security for customers by providing a safer alternative to carrying cash or using credit and debit cards, which have suffered from security vulnerabilities. (Lu, 2019:1136)

The factors contributing to the emergence of electronic payment systems were as follows: (Dweiss & Tras, 10:2024)

- The development of information technology: The use of modern technology is a fundamental element in the operations of banks both locally and globally. This necessitated the improvement of banking services and the use of electronic payment services.
- The emergence of e-banking and new banking services, which rely on an electronic infrastructure to provide banking services to customers securely, at a lower cost, faster, and with less effort.
- The emergence of the internet: These networks enable the transfer of information easily and efficiently in terms of both cost and time.
- The emergence of global financial institutions and organizations.

The Concept of Banking Efficiency

Banks are efficient if they can direct their available economic resources toward achieving the highest possible returns with the least possible waste or cost. This means successfully controlling their material and human resources on the one hand, and achieving optimal size and offering a wide range of financial products on the other (Hussein et al., 2024:43). Banking efficiency can be defined as the ability of banks to achieve outputs with the least amount of inputs (Alber et al., 2019:2). The concept of bank efficiency refers to the ability of banks to optimally utilize their resources to produce maximum output and provide services to customers, such as loans and deposits, at the lowest possible cost (Fauziyah, 2025:18). Higher efficiency is achieved when output is higher per unit of input. When the highest output is achieved per unit of input, efficiency is reached. In this case, efficiency can only be increased by introducing new technologies or changing something in the production process (Tawfiq, 2021:437). The importance of banking efficiency can be summarized as follows:

- Adherence to lending standards set by monetary authorities leads to the elimination of non-performing loans, which negatively impact asset quality and, consequently, bank profitability.
- High efficiency rates result in effective and efficient management that reduces operating expenses and unnecessary costs, positively impacting the bank's net income. This allows for the exploration of new investment opportunities to utilize available bank funds and achieve higher profits at lower costs through a long-term investment diversification strategy that distributes and mitigates investment risks. (Ashour & Hamza, 2020:286)
- Banking efficiency ensures financial stability, product innovation, and the provision of financial services. Once banking efficiency indicators are defined, resources can be allocated consciously and effectively by identifying the essential elements. Therefore, banks must possess high technical efficiency to achieve greater productivity with a given level of inputs, including labor, capital, and technology. (Abel et al., 2024:2)

Types of Banking Efficiency

- **Technical Efficiency**: Technical efficiency is a component of economic efficiency, but it represents a narrower concept. In banks, technical efficiency is achieved when the bank can reach a specific or planned level of output or banking services using the minimum amount of inefficient inputs, such as capital, labor, and technology, or when

it can achieve the maximum possible output with a given level of available inputs. (Kulik, 2017:77)

- **Operational Efficiency**: Operational efficiency in banks is defined as the ability to utilize available human and other resources to the fullest extent possible to provide the required banking services at the lowest possible cost. This efficiency includes the bank's ability to direct resources toward achieving the highest possible return while minimizing waste, optimizing the scale of operations, and diversifying banking products and services to achieve the best allocation of costs and maximize economic benefit. (Al-Khafaji, 2021:50)
- **Specialized Efficiency**: Specialized efficiency refers to the optimal use of inputs. It involves selecting the optimal ratio of inputs at their given prices. However, changes in specialized efficiency become highly significant, and specialized efficiency measures the optimal mix of inputs to maximize efficiency, such as the introduction of ATMs and electronic banking services by banks to achieve a balance between capital and labor. (Ullah et al., 2023:3)
- **Relative Efficiency**: This is a measure of efficiency, whether technical or specialized, for one or more banks within the same banking sector. This means that these banks operate in the same sector and specialize in the same banking services, by comparing the same ratios in the use of production stages. (Al-Anzi, 2022:119)

METHODOLOGY

Research Model: This study has two variables, as follows:

- Independent Variable: Mobile Payment Systems as an Artificial Intelligence Tool
- Dependent Variable: Enhancing banking Efficiency

Descriptive analysis: The Central Bank of Iraq (CBI): The Central Bank of Iraq was established in 1947 under the name of the National Bank of Iraq and its name was changed in 1956 to the Central Bank of Iraq under the amended National Bank Law No. (72), from which monetary policy was set. It is worth mentioning that the Central Bank of Iraq is one of the first central banks established in the Arab countries and the Middle East region (Shaheen, 2025:89). Its main function is not to make a profit, but rather to stabilize the monetary and banking system (Tawfiq, 2022:153). The Central Bank of Iraq occupies a leading position in the banking system as it has supervisory authority over banks. The Central Bank ensures that all banks adhere to its monetary policy and maintain and invest foreign exchange reserves. The Central Bank is the lender of last resort and the entity responsible for monetary policy, and issuing currency is one of its oldest functions (Al-Majma'i, 2023:355).

RESULTS AND DISCUSSION

Analyse Role of Growth Rate of Mobile Electronic Payment Systems on Growth Rates of Productivity Indicators for Period (2018-2024). The researchers will perform analysis using table as follows:

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Table 1: Analysis of Role of Growth Rate of Mobile Electronic Payment Systems on Growth Rates of Profitability Indicators for Period (2012-2024)

Years	Mobile payment indicator	Profitability Indicators	
	Total Growth Rate of Mobile Electronic Payments %	Return on Assets Growth Rate %	Return on Equity Growth Rate %
2018	126.51	-36.47	-52.41
2019	122.08	53.70	62.52
2020	67.95	6.02	2.81
2021	-35.26	-36.36	-30.23
2022	17.09	91.07	131.56
2023	380.13	2.80	2.28
2024	15.09	1.81	-8.02
Total	693.59	82.57	108.51
Average	99.08	11.79	15.50
Maximum	380.13	91.07	131.56
Minimum	-35.26	-36.47	-52.41

Source: Prepared by Researchers Based on the Annual Statistical Bulletin, Central Bank of Iraq, Department of Statistics and Research, for the Period (2018-2024)

Table above shows the initial adoption of mobile payments as an artificial intelligence tool during the study period, with a growth rate of 126.51% in 2018. However, profitability indicators recorded negative growth rates, with the return on equity (ROE) falling by 52.41% and the return on assets (ROA) by 36.47%. This reflects the continued burden on banks of high capital costs associated with developing digital infrastructure and smart systems. In 2019, a radical shift occurred in the relationship between mobile payments and profitability. The growth rate of ROE rose to 62.52%, and the return on assets reached 53.70%, coinciding with a continued decline in the growth rate of mobile payments, which reached 122.08%. This shift indicates that banks have entered a phase of reaping the returns on their investments in artificial intelligence. Smart systems contributed to reducing operating costs, improving credit risk, and increasing the volume of digital banking transactions, which directly impacted assets and equity.

In 2020, indicators continued to improve, with the return on equity (ROE) reaching 2.81% and the return on assets (ROA) reaching 6.02%. Electronic payments maintained their growth rate at 67.95%. This relative slowdown indicates that banks were restructuring their digital operations and strengthening their reliance on electronic channels, which led to stable profitability indicators at positive levels despite economic challenges. However, 2021 witnessed a significant decline in electronic payments with a negative growth rate of 35.26%, which directly affected profitability indicators. The ROA growth rate fell to 30.23%, and the return on assets to 36.36%. This confirms the strong relationship between the level of electronic payment penetration and bank profitability, as a decrease in the volume of digital transactions leads to lower revenues and increased operating burdens on traditional branches. 2022 marked a significant turning point, with the return on equity (ROE) reaching its highest level during the study period, achieving a growth rate of 131.56%. The return on assets (ROA) also rose to 91.07%, while electronic payments remained stable at a growth rate of 17.09%. This exceptional increase reflects the banks' attainment of a stage of digital maturity, where artificial intelligence systems are now capable of improving asset management, increasing resource allocation efficiency, and maximizing revenues relative to costs. In 2023, the growth rate of electronic payments reached its highest level during the study period, reaching 380.13%.

However, profitability indicators remained at moderate growth rates, with the ROA growing at 2.28% and the ROA at 2.80%. This can be explained by the fact that the significant expansion in electronic payments was accompanied by additional investments in infrastructure and the expansion of digital services, which used a portion of profits for development and expansion expenses. In 2024, profitability indicators stabilized at positive growth rates, with the return on equity (ROE) reaching -8.02% and the return on assets (ROA) reaching 1.81%. The growth rate of electronic payments continued to rise to 15.09%, indicating that banks had entered a period of stability following the significant digital transformation. Overall, the analysis confirms a long-term relationship between the growth of mobile payment systems and improved profitability indicators. In the short term, digital investment leads to a decrease in profitability, but in the medium and long term, there is a noticeable improvement in profitability indicators due to lower operating costs, improved risk management, and increased transaction volume.

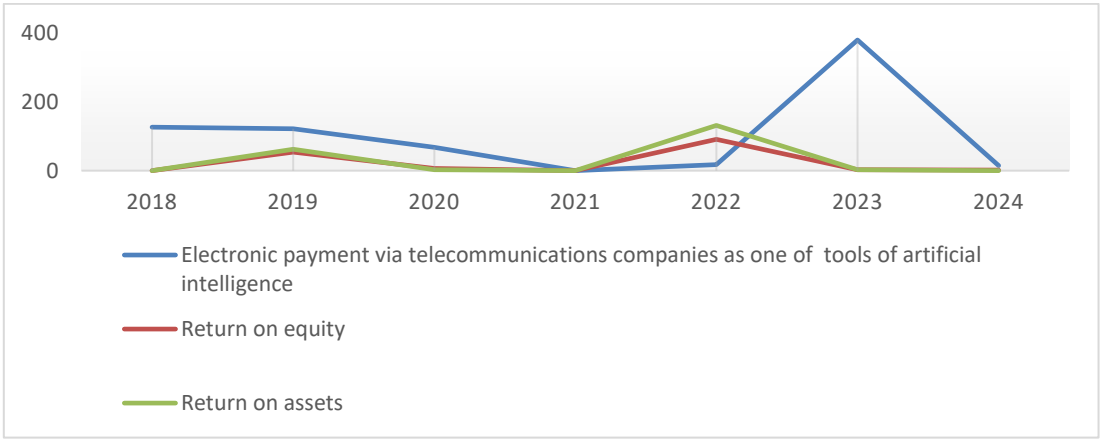

Figure 1: Convergence between Mobile Payment Indicator, Implemented by Telecommunications Companies as an Artificial Intelligence Tool, and Profitability Indicators for Period (2018-2024), Excluding Last Two Years

Source: Prepared by Researchers based on Table 1

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Analysis of Role of Growth Rate of Mobile Electronic Payment Tools, as an Artificial Intelligence Tool, in Development of Productivity Indicators for Period (2018-2024)

Table 2: [1]Analysis of Role of Growth Rate of Mobile Electronic Payment Tools, as an Artificial Intelligence Tool, in Development of Productivity Indicators for Period (2018-2024)

Years	Total Growth Rate of Mobile Electronic payments	Asset Growth Rate per Employee	Profit Growth Rate per Employee	Revenue Growth Rate per Employee	Deposit Growth Rate per Employee	Loan Growth Rate per Employee
2018	126.51	-14.61	-76.66	-8.26	24.62	11.52
2019	122.08	1.83	56.24	5.02	0.46	25.58
2020	67.95	3.85	13.35	65.27	3.16	18.16
2021	-35.26	30.48	-16.66	-19.35	28.18	32.52
2022	17.09	35.84	152.69	34.50	46.63	13.45
2023	380.13	-11.23	-18.82	24.85	-11.16	-1.78
2024	15.09	3.81	4.33	25.27	-3.55	11.13
Total	693.59	49.97	114.47	127.3	88.32	110.58
Average	99.08	7.13	16.35	18.18	12.61	15.79
Maximum	380.13	35.84	152.69	65.27	46.63	32.52
Minimum	-35.26	-14.61	-76.66	-19.35	-11.16	-1.78

Source: Prepared by Researchers based on Annual Statistical Bulletin, Central Bank of Iraq, Department of Statistics and Research, for Period (2018-2024)

2018 marked a turning point in the adoption of mobile payments in banks, with record-breaking growth rates of 126.51%, coinciding with a significant improvement in most productivity indicators. Deposits per employee grew by 24.62%, loans per employee by 11.52%, and deposits per employee by 24.62%. These results indicate the beginning of reaping the economic returns from investing in artificial intelligence tools. Mobile payments have contributed to reducing the time required to complete banking transactions and lowering operating costs. In 2019, electronic payment levels maintained their high growth rate of 122.08%. Revenue per employee improved by 5.02%, while loans per employee continued to rise by approximately 25.58%, and profit per employee recorded a growth rate of 56.24%. This reflects banks' shift from the investment phase to the operational phase, with the introduction of artificial intelligence tools for creditworthiness analysis and expedited loan approval procedures. This led to an increase in lending volume without the need for staffing increases, demonstrating improved operational efficiency. In 2020, although the growth rate of electronic payments decreased to 67.95%, revenue per employee witnessed a significant jump, recording a growth rate of 65.27%, reflecting the accelerated adoption of digital technology. The loan-per-employee growth rate continued to rise, reaching 18.16%, while the profit-per-employee growth rate reached 13.35%, demonstrating the effectiveness of smart systems in maximizing revenue from digital services and reducing reliance on traditional branches.

2021 witnessed a significant decline in the electronic payment growth rate, registering a negative growth rate of (-35.26%), which directly impacted productivity indicators. The revenue-per-employee growth rate decreased to (-19.35%) and profit-per-employee to (-16.66%). This decline reflects the impact of electronic payments on banking performance, confirming the strong correlation between the spread of electronic payments and bank

[1] All values in table are percentages.

productivity levels. 2022 marked a significant turning point during the study period, with the profit-per-employee growth rate reaching its highest value at 152.69%, coinciding with an increase in the asset-per-employee growth rate to 35.84% and deposits-per-employee growth to 46.63%. This exceptional increase indicates the maturity of the electronic payment system, enabling banks to achieve economies of scale and significantly reduce operating costs. This, in turn, led to a doubling of bank employee productivity. In 2023, electronic payments reached their highest level during the study period, registering a growth rate of 380.13%, representing a tremendous digital leap. Despite a partial decline in some productivity growth rates due to economic fluctuations, the continued growth in revenue per employee reached 24.85%. In 2024, the indicators stabilized at positive growth rates, with the loan-to-employee ratio growing at 11.13%, revenue per employee at 25.27%, and profit per employee at 4.33%. This stability indicates that banks have entered a phase of digital sustainability. Overall, the data in the table shows a clear positive relationship between mobile-enabled electronic payment systems and improved employee productivity. The expansion of electronic payment use has led to reduced operating costs and increased the volume of banking transactions without requiring additional human resources, thus contributing to improved efficiency in banking operations. and Figure below illustrates the convergence between the mobile payment indicator, as an artificial intelligence tool, and productivity indicators for the period (2018-2024).

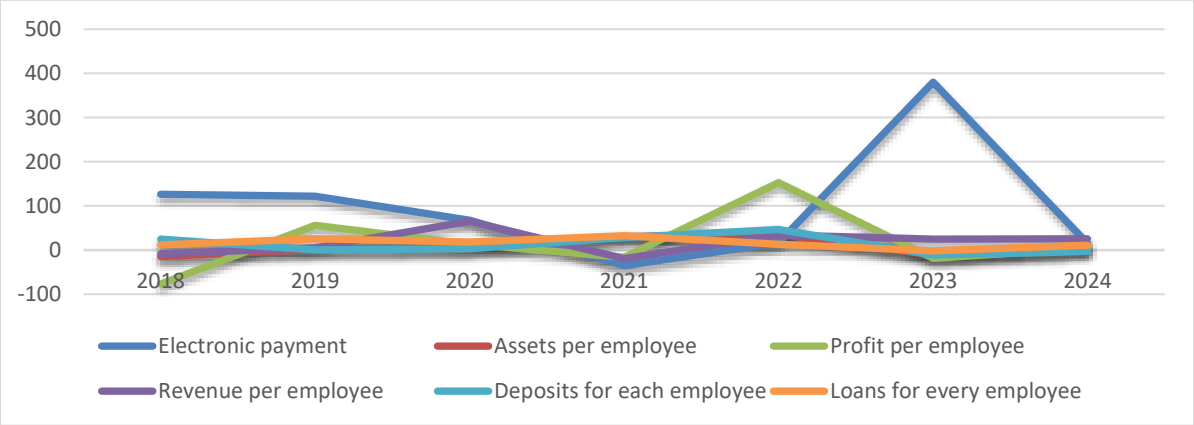

Figure 2: Development of Mobile Payment Indicator, as an Artificial Intelligence Tool, and Productivity Indicators for Period (2018-2024)

Source: Prepared by Researchers based on Table 2

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Analysis of Role of Development of Growth Rate of Mobile Electronic Payment Tool as one of Artificial Intelligence Tools in Development of Growth Rates of Financial Intermediation for Period (2018-2024).

Table 3: Analysis of Development of Growth Rates of Electronic Payment via Mobile as one of Artificial Intelligence Tools in Development of Growth Rates of Asset Utilization Efficiency and Financial Intermediation for Period (2012-2024)

Years	Total Mobile Electronic Payment Growth Rate	Financial Intermediation Growth rate
2018	126.51	-10.46
2019	122.08	25.04
2020	67.95	14.50
2021	-35.26	-5.98
2022	17.09	-14.88
2023	380.13	10.50
2024	15.09	15.25
Total	693.59	33.97
Average	99.08	4.85
Maximum	380.13	25.04
Minimum	-35.26	-14.88

Source: Prepared by Researchers based on Annual Statistical Bulletin, Central Bank of Iraq, Department of Statistics and Research, for Period (2018-2024)

The table above shows a clear variation in growth rates between years, reflecting the impact of economic and technological changes on the banking sector. In 2018, mobile electronic payments recorded a high growth rate of 126.51%, while financial intermediation saw a decline in its growth rate of (-10.46%), indicating that the initial expansion of electronic payments was in its foundational stage and did not directly translate into improved financial intermediation. In 2019, the growth rate of electronic payments maintained its high level at 122.08%, coinciding with an improvement in the growth rate of financial intermediation to 25.04%, demonstrating the beginning of the positive impact of using electronic payments in supporting financial intermediation activity. In 2020, the growth rate of electronic payments decreased to 67.95%, while the growth rate of financial intermediation remained positive at 14.505%, reflecting the continued supportive impact of electronic payments despite their slower growth. In 2021, the growth rate of electronic payments declined by 35.26%, while the growth rate of financial intermediation fell to 5.98%, indicating the negative impact of the decline in the electronic payment index. In 2022, the growth rate of electronic payments rebounded to 17.09%, while the growth rate of financial intermediation continued to decline, registering a negative growth rate of 14.88%. This suggests that the improvement in electronic payments was insufficient to address the challenges facing the banking sector.

However, in 2023, the growth rate of electronic payments recorded an exceptional increase of 380.13%, coinciding with an improvement in the growth rate of financial intermediation to 10.50%. This reflects the significant positive impact of expanding the range of electronic payment methods in supporting the efficiency of financial intermediation. In 2024, the growth rate of electronic payments stabilized at 15.09%, while the growth rate of financial intermediation continued to improve, reaching 15.25%, indicating that the relationship between them had entered a phase of relative stability. This confirms that the expansion of electronic payment use gradually contributes to enhancing the performance of financial intermediation

and improving the efficiency of banking asset utilization. And from Figure below we show convergence between mobile electronic payment index and the financial intermediation index.

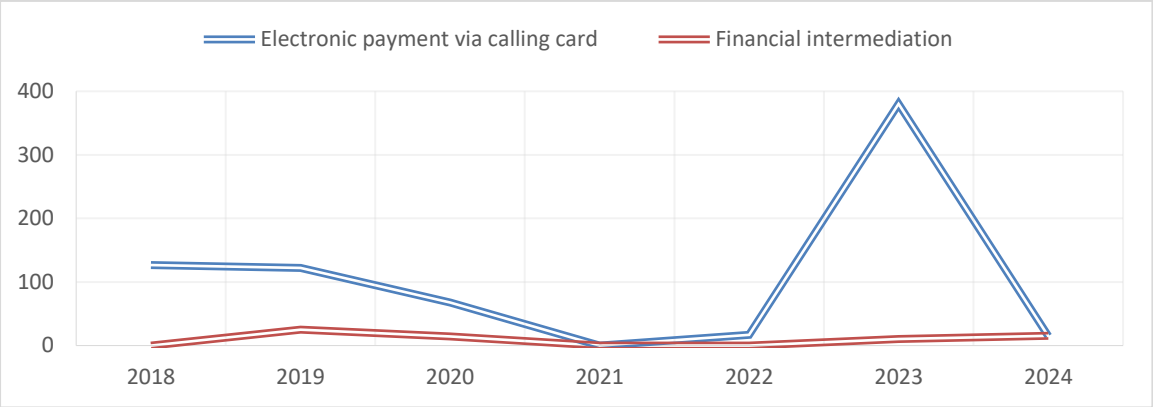

Figure 3: Evolution of AI-enabled Mobile Payment Index and Financial Intermediation Index for Period (2018-2024)

Source: Prepared by Researchers based on Table 3.

Conclusion

- The study demonstrated a positive relationship between mobile electronic payments, as an artificial intelligence tool, and increased employee productivity. This is attributed to reduced operational costs and less time and effort required to complete banking transactions.
- The analysis showed that implementing electronic payments in their initial stages leads to a temporary decrease in profitability due to higher investment costs.
- In the long term, artificial intelligence contributes to achieving high profitability and maximizing the return on assets and return on equity.
- The expansion of mobile electronic payments has contributed to improving financial intermediation and enhancing banks' ability to allocate resources more efficiently.
- Mobile electronic payments have become a key element in achieving sustainability and operational efficiency for banks.

Recommendations

- The research recommends increasing investment in artificial intelligence and electronic payment technologies to enhance banking efficiency.
- Developing digital infrastructure and expanding the scope of electronic services to reduce reliance on traditional branches.
- Training bank employees on the use of modern and smart technologies and enhancing their digital transformation skills.
- Supporting policies for transitioning to a digital economy to promote financial inclusion and increase the volume of financial transactions.

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