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Scenarios of Development of the Banking System of Uzbekistan Until 2030: Forecasting Based on Cagr Models

Elyor Ilkhomovich Saidov¹

1. Independent Researcher, Tashkent State University of Economics, Uzbekistan

* Correspondence: elyorsaidov@yahoo.com

Abstract: This article provides a comprehensive scientific and empirical analysis of the impact of digital transformation on financial efficiency in the banking system of Uzbekistan, with projections for the period up to 2030. A comparative analysis with Central Asian banking sectors reveals that Uzbekistan leads the region in terms of Return on Assets (ROA — 2.7%) and capital adequacy (21.2%), while also recording the lowest non-performing loan ratio (NPL — 2.9%). Under the optimistic scenario, total banking assets are projected to reach 1,725 trillion soums by 2030, with digital transactions accounting for 97% of all operations and net profit reaching 50.5 trillion soums. The findings demonstrate that the integration of artificial intelligence, machine learning, and fintech solutions can reduce operational costs by up to 9.1%, increase lending speed by 14.2%, and significantly broaden the geographic coverage of banking services, thereby accelerating the integration of Uzbekistan's banking sector into global financial markets.

Keywords: Digital Transformation, Financial Efficiency, Fintech, Banking System, ROA, ROE, NPL, CAGR, Scenario Analysis, Central Asia, Artificial Intelligence, Forecasting, Banking Reforms, Digital Operations

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1. Introduction

In the global economy, the necessity of enhancing the financial efficiency of commercial banks is of critical importance from both strategic and macroeconomic perspectives — not only to ensure the sustainable operation of banks themselves, but also to contribute to the stable growth of the global economy. In recent years, despite the diverse global trends in profitability indicators for banks, the overall picture demands improvements in efficiency under the pressure of intense competition and innovative change. For example, at the end of 2024, the average return on assets (ROA) in European banks was approximately 0.5 percent, while in North American banks this figure was 1.2 percent, and in Asian banks it was 1.0 percent. This indicates that there are certain differences in the profitability of banking systems worldwide.

At the same time, one of the important criteria for expressing efficiency - the cost-to-income ratio - was approximately 62.5 percent in Europe, 57.3 percent in North America, and 54.6 percent in Asia. These figures clearly demonstrate the uneven level of operational efficiency between different regions [1].

From the above data, it can be concluded that commercial banks need to develop and implement strategic measures aimed at increasing the efficiency of their activities in the conditions of global competition. Because low profitability and high operating costs reduce

the competitiveness of banks in the market and limit their opportunities for long-term sustainable development.

The necessity of conducting scientific research on the improvement of financial efficiency of commercial banks in the global financial environment is of decisive importance for the sustainable implementation of growth strategies. In recent years, academic literature on bank efficiency analysis has increasingly focused on profitability indicators (such as ROA and ROE), cost efficiency, and risk-adjusted returns, which allows for a rigorous mathematical assessment of banks' financial performance [2]. In addition, scientific studies based on empirical and statistical approaches analyze the effectiveness of banks from the perspective of the relationship between corporate governance and financial performance. In this regard, modern assessment methods such as Data Envelopment Analysis (DEA), Stochastic Frontier Analysis (SFA) and CAMELS are widely used. Through these methods, the level of resource utilization, the quality of risk management and financial stability indicators of bank activities are comprehensively studied.

At the same time, some issues remain under-explored in existing research. In particular, the impact of digital transformation processes and the integration of FinTech solutions into banking activities on financial performance has not yet been summarized in the scientific literature based on complete and consistent empirical evidence. This indicates the need for additional scientific research in this area.

Many studies lack a complex strategic analysis of how digital technologies may increase operational costs in the short term, or how they positively affect long-term profitability through enhanced customer experience. Additionally, banks' strategies for maintaining efficiency during economic crises and their interaction with the macroeconomic environment remain insufficiently studied. For these reasons, conducting scientific research into improving the financial efficiency of commercial banks is required not only for its theoretical value but also for its practical relevance in developing operational strategies [3].

The need for a scientific in-depth study of the financial efficiency of commercial banks in the conditions of Uzbekistan is becoming increasingly urgent against the backdrop of the ongoing large-scale economic reforms. After all, a thorough scientific analysis of the banking system's activities creates a solid theoretical and practical basis for the effective implementation of measures aimed at ensuring macroeconomic stability, as well as the consistent implementation of strategies to support the private sector.

As a result of reforms aimed at adapting the banking system and financial markets in the country to international standards, attracting foreign investment, and developing the capital market, the volume of bank assets in recent years has increased by 5.3 times, reaching more than 877 trillion soums. Currently, 35 banks operate in the banking sector of the republic.

This dynamics indicates that the scale and importance of the banking system are increasing. Therefore, a comprehensive assessment of its financial efficiency, determination of the level of resource utilization, and a scientific analysis of the effectiveness of institutional reforms are among the priority tasks. International experts have acknowledged concrete steps taken to strengthen oversight of banks, improve risk management, and enhance financial stability, which further confirms the importance of banking efficiency. Moreover, the imperative to make banks' operations sustainable, competitive, and integrated into global financial markets, to improve service quality, and to analyze and optimize banking efficiency further amplifies the practical importance of scientific approaches in this domain [4].

Literature Review

The importance of institutional and structural reforms in improving banking performance is paramount, and in this process, the improvement of state-based financial

regulatory mechanisms and the strengthening of banking supervision play critical roles. The consistent and stable implementation of monetary policy by the central bank serves to control inflationary processes, ensure the stability of the national currency, and create a favorable investment climate. These factors establish the necessary conditions for the stable functioning and long-term development of the banking system. Combating corruption, reducing the share of the shadow economy, and strengthening public trust in the banking system to expand financial inclusion are among the most pressing challenges. An increase in the confidence of the population and business entities in formal financial institutions creates the foundation for broadening banks' resource bases and effectively carrying out financial intermediation functions [5].

Matuwa and Nyangu's study analyzed the relationship between the quality of bank earnings and their efficiency in developing countries of East Africa and the impact of financial and banking crises on this relationship. The authors emphasize that the quality of bank earnings directly affects the transparency of financial reporting, effective asset management and accurate risk assessment. According to the results of an empirical analysis using the dynamic panel regression method based on panel data formed on commercial banks in East Africa for the period 2005–2020, banks with high earnings quality also have high efficiency, but financial and banking crises weaken this positive relationship; in particular, increased credit risks and liquidity shortages in crisis conditions lead to a decrease in efficiency. In this regard, the authors justify the need to introduce strict regulatory measures aimed at ensuring financial stability, increasing reporting transparency and preventing crises [6].

Scientific and theoretical approaches aimed at improving the efficiency of commercial banks' loan portfolios are of great importance in improving the overall financial performance of banks and managing risks prudently. Loan portfolio efficiency is one of the key factors ensuring the profitability and financial stability of banks, and this area occupies a central place in banking activities. Scientific research examines the issue of improving loan portfolio efficiency from various perspectives. Portfolio diversification, the implementation of digital technologies, and the effective management of credit risks are among these approaches. Diversification allows banks to reduce risks across various industries and sectors and to form stable revenue streams. In addition, modern digital technologies and big data analytics tools expand the possibilities for monitoring and managing the loan portfolio in real time. Forecasting methods and analytical models developed for credit risk management serve to minimize potential loan losses and improve portfolio quality [7].

Scientific approaches to improving loan portfolio efficiency are not limited to analyzing theoretical aspects alone, but are also directed at improving the methodologies applied in banking practice. In particular, approaches such as the use of statistical and economic models for credit risk assessment, in-depth analysis and forecasting of borrowers' financial condition, optimization of portfolio diversification levels, and minimization of errors in the loan recovery process are enabling significant improvements in bank efficiency. These scientific and theoretical approaches not only ensure the sustainable growth of banks but are of great importance in contributing to overall economic stability. Introducing best practices for improving loan portfolio efficiency strengthens banks' social responsibility, consolidates customer trust, and supports sustainable and inclusive development in the economy [8].

Venugopal's research focuses on analyzing the management of loan portfolios and efficiency among public sector, old private sector, and new private sector banks in India. The scientific study theoretically analyzes the components of banks' loan portfolio management, credit risk assessment methods, and the ways in which portfolio management affects bank efficiency. Empirically, Venugopal uses panel data to analyze the financial performance of Indian banks and compares key efficiency indicators (such as

return on assets and capital adequacy ratios) across different bank types. The research findings demonstrate that new private sector banks show better efficiency compared to public sector banks, and that more active utilization of digital technologies in loan portfolio management plays an important role in increasing efficiency. The author states that the implementation of credit risk management practices based on digital technologies will significantly reduce the share of problem loans and improve the overall quality of the bank's loan portfolio.

Huynh and Dang's study analyzed the impact of loan portfolio diversification and changes in bank business models on financial performance and efficiency. The authors conducted a panel regression analysis based on data from commercial banks and studied the relationship between diversification strategies and key financial indicators such as ROA, ROE, and NIM. According to the results of the study, moderate diversification of the loan portfolio serves to increase financial efficiency, but excessive diversification can complicate risk management and lead to a decrease in overall efficiency. It was also found that efficiency indicators are higher in banks that develop non-traditional sources of income, such as commissions and fees, in addition to traditional interest income. The authors emphasize that ensuring the optimal balance between diversification and specialization in banking practice is crucial for the formation of effective risk management strategies [9].

The study by Maarif et al. provides a systematic literature review covering various dimensions of bank efficiency, competitiveness, and resilience, examining scientific works that employ methodologies such as DEA (Data Envelopment Analysis) and SFA (Stochastic Frontier Analysis). The research synthesizes findings across different dimensions of banking efficiency, including operational efficiency, cost efficiency, and risk-adjusted performance. According to the research findings, banks that implement digital innovations, improve risk management practices and have a strong corporate governance system demonstrate higher performance indicators. In particular, financial institutions that consistently apply modern technologies and regulatory requirements operate relatively more stably in the face of economic crises and have the ability to recover faster after negative shocks.

The study by Bueno et al. is devoted to studying the impact of digitalization processes on operational efficiency in the banking sector, analyzing how the introduction of digital technologies such as online banking, mobile banking, and automated financial services affects banks' cost structure and revenue sources. According to the results of the analysis, conducted on the basis of extensive data formed on a cross-section of banks in several countries, banks with a high level of digitalization experience a decrease in the cost-to-income ratio, as well as an increase in return on assets (ROA). At the same time, the study notes that the positive effects of digital transformation may not be immediately apparent, since it is possible that initial investments in technology infrastructure may temporarily reduce profitability in the short term. These conclusions are of particular practical importance in the conditions of Uzbekistan, especially at a time when rapid digital transformation is underway in the banking system [10].

Research by Addy et al. examines the application of predictive analytics in credit risk management for banks, exploring how Business Intelligence and machine learning tools can enhance the accuracy of credit assessments and reduce loan defaults. The study reports that banks implementing these tools observed a 12.7% improvement in loan portfolio returns, an 8.3% reduction in loan delinquency rates, and a 6.5% decrease in operational costs. These empirical results scientifically substantiate the need to expand the use of predictive analytics in the banking sector of Uzbekistan.

The study, conducted by Bao and co-authors, analyzed the opportunities and challenges of financial technology (fintech) innovations, paying particular attention to their impact on bank efficiency and financial inclusion. According to the authors, banks

that actively integrate fintech tools have increased their loan disbursement speed by an average of 14.2 percent, reduced transaction costs by 9.1 percent, and reduced default rates by 6.8 percent. The results of the study show that financial technology has great transformative potential, especially for banks in emerging markets, and in particular, it can serve as an important factor in expanding access to services for the population and businesses in regions that are not sufficiently covered by financial services.

2. Material and Methods

The study employs the following scientific and analytical methods:

Economic-statistical methods: Data Envelopment Analysis (DEA), Stochastic Frontier Analysis (SFA), and Trend Extrapolation based on Compound Annual Growth Rate (CAGR) calculations.

Scenario planning: Three development scenarios (optimistic, baseline, and pessimistic) were constructed using macroeconomic assumptions regarding GDP growth, inflation, and regulatory conditions.

General scientific methods: Scientific abstraction, comparative and structural analysis, induction and deduction, and economic-statistical assessment.

Data sources: The Central Bank of the Republic of Uzbekistan, World Bank reports, Bank for International Settlements (BIS), and international academic publications.

The forecasting methodology for the 2025–2030 period is based on CAGR modeling, which projects future values of key banking indicators by applying average annual growth rates derived from historical trends observed during 2020–2024. The scenarios are differentiated by the assumed pace of GDP growth (3.5–4.5% for pessimistic, 5.5–6.5% for baseline, and 7.5–8.5% for optimistic scenarios) and the speed of digital transformation [11].

3. Results and Discussion

To assess the Table 1. And Table 2. potential and competitiveness of Uzbekistan’s banking system, a regional comparative analysis was conducted with Central Asian states. While Kazakhstan’s banking system is considered the most advanced in the region, Uzbekistan is closing the gap through the reforms implemented over the past five years. The banking systems of Kyrgyzstan and Tajikistan are characterized by smaller volumes and limited resources [12].

Table 1. Comparison of Central Asian Banking Sectors (2024)

Country	Assets/GDP (%)	Average ROA (%)	Average ROE (%)	NPL Ratio (%)	Capital Adequacy (%)	Dollarization (%)
Uzbekistan	45.2%	2.7%	17.8%	2.9%	21.2%	33.8%
Kazakhstan	68.5%	2.1%	14.5%	4.2%	17.8%	42.5%
Tajikistan	32.8%	2.8%	18.5%	5.8%	19.3%	51.2%
Kyrgyzstan	35.4%	2.3%	15.7%	6.5%	18.7%	47.8%
Turkmenistan	28.2%	1.9%	13.2%	3.5%	16.5%	38.4%

Table 2. Uzbekistan vs. Regional Averages — Key Differentials

Indicator	Uzbekistan	Regional Average	Difference	Uzbekistan’s Position
Financial Depth	45.2%	42.0%	+3.2%	2nd place
ROA	2.7%	2.4%	+0.3%	1st place
ROE	17.8%	15.5%	+2.3%	2nd place
NPL Ratio	2.9%	4.5%	–1.6%	1st place (lowest)

Capital Adequacy	21.2%	18.5%	+2.7%	1st place (highest)
Dollarization	33.8%	44.7%	-10.9%	2nd place (lowest)

As Table 1 and Table 2 demonstrate, Uzbekistan's banking sector has achieved leading positions across most key performance indicators within the Central Asian region. The country's ROA of 2.7% significantly surpasses the global benchmarks of Europe (0.5%), North America (1.2%), and Asia (1.0%), reflecting the strong profitability of the banking sector driven by wide interest rate spreads and a relatively young, high-growth economy. The capital adequacy ratio of 21.2% — more than double the Basel III minimum requirement of 10% — underscores the robustness of the banking system's capital base. The NPL ratio of 2.9% represents the lowest level in the region and reflects a substantial improvement in asset quality from 6.4% in 2020, achieved through tighter credit underwriting standards, improved debt recovery mechanisms, and the positive effects of economic growth on borrowers' debt-servicing capacity [13].

Forecasting Methodology

The study Table 3. And Table 4. applies Trend Extrapolation (CAGR), macroeconomic correlation analysis, and Scenario Analysis (Baseline, Optimistic, and Pessimistic) modeling approaches. Banking assets are projected to grow at an annual rate of approximately 12–18% over the period 2025–2030.

Table 3. Long-Term Forecast Indicators for Banking System Development (2025–2030)

Indicator	2024 (Actual)	2027F	2030F	Growth (2024–2030)
Assets (trln soums)	652.2	1,105	1,725	+164.5%
Assets (USD bln)	53.7	86.5	131.8	+145.4%
Loan Portfolio (trln soums)	471.4	808	1,277	+170.9%
Capital (trln soums)	97.1	163	255	+162.6%
Net Profit (trln soums)	14.8	27.8	50.5	+241.2%
ROA (%)	2.7%	3.2%	3.8%	+1.1 p.p.
NPL Ratio (%)	2.9%	1.9%	1.3%	-1.6 p.p.
Assets/GDP (%)	41.8%	50.3%	61.4%	+19.6 p.p.

Table 4. Projected Average Annual Growth Rates (%)

Indicator	Average Annual Growth Rate (CAGR, 2024–2030)
Total Assets	+17.6%
Loan Portfolio	+18.1%
Capital	+17.5%
Deposits	+17.4%
Net Profit	+22.7%

The Table 5. projected CAGR of 22.7% for net profit reflects the combined effect of expanding asset volumes, improving asset quality (declining NPLs), widening interest margins sustained by economic growth, and the efficiency gains generated by digital transformation. The accelerating shift toward digital banking channels is expected to reduce unit transaction costs, lower the cost-to-income ratio, and enable banks to serve a broader customer base without a proportional increase in physical infrastructure [14].

Table 5. Scenario Analysis (Projections for 2030)

Indicator	Pessimistic (15% probability)	Baseline (55% probability)	Optimistic (30% probability)
GDP Growth Rate	3.5–4.5%	5.5–6.5%	7.5–8.5%
Total Assets (trln soums)	1,280	1,725	2,150
ROA (%)	2.2%	3.8%	4.5%
NPL Ratio (%)	4.2%	1.3%	0.8%
Dollarization Level (%)	28%	18%	10%
Share of Digital Operations	85%	92%	97%
Financial Services Coverage	75%	82%	88%

The pessimistic scenario assumes a deceleration in structural reforms, a slowdown in digital adoption, and heightened external economic pressures. Under this scenario, asset quality would deteriorate (NPL rising to 4.2%), profitability would weaken (ROA falling to 2.2%), and digital operations would represent 85% of total transactions. The baseline scenario reflects the continuation of current reform trajectories and assumes steady economic growth of 5.5–6.5%, with total assets reaching 1,725 trillion soums, ROA improving to 3.8%, NPLs declining to 1.3%, and digital operations accounting for 92% of all transactions by 2030. The optimistic scenario envisions an acceleration of reforms, a rapid deepening of financial markets, and the successful integration of advanced technologies (AI, machine learning, and blockchain), which would drive total assets to 2,150 trillion soums, ROA to 4.5%, NPLs to 0.8%, and digital operations to 97% of all transactions, while the dollarization rate would fall to just 10% [15].

4. Conclusion

Based on the analysis conducted, the following conclusions and strategic recommendations can be drawn:

1. Results of Digital Transformation. Over the period 2020–2024, banking assets grew 5.3-fold. Uzbekistan's ROA (2.7%) rose to first place in the region. The share of digital operations reached 79.2%.

2. Efficiency Gains. Business Intelligence and predictive analytics tools have been shown to increase loan portfolio returns by 12.7%, reduce loan delinquency rates by 8.3%, and cut operational costs by 6.5%. Integrating FinTech solutions into banking activities will further enhance these positive results: in particular, the speed of the lending process will increase by an average of 14.2 percent, operational costs will decrease by 9.1 percent, and the default rate will decrease by 6.8 percent.

3. Growth projections. According to the baseline scenario, by 2030, banking assets are expected to reach 1,725 trillion soums. It is also projected that 92 percent of total transactions will be carried out through digital services. Net profit of the banking sector is expected to reach 50.5 trillion soums, which is an increase of 241.2 percent compared to the level in 2024.

4. Strategic Directions. To ensure the sustainable development of Uzbekistan's banking sector, the following measures are recommended:

— Integration of Artificial Intelligence and Big Data into Risk Management: AI-powered credit scoring and early warning systems should be implemented across all major banks to reduce NPLs and improve the accuracy of credit assessments.

— Development of the Fintech Ecosystem and a Regulatory Sandbox: Creating a supportive regulatory environment for fintech startups and establishing a regulatory sandbox will accelerate innovation while managing systemic risks.

— Strengthening cybersecurity infrastructure. In the context of the increasing volume of digital transactions, the formation of an effective and reliable cybersecurity system becomes a priority. Since the implementation of modern protection mechanisms is crucial for maintaining customer trust, ensuring the integrity of financial data, and guaranteeing the stable and secure functioning of the entire financial system.

— Expanding financial inclusion through mobile and agency banking. In rural areas and regions where financial services are not sufficiently developed, the introduction of mobile banking applications and the implementation of agency banking models will serve to expand the coverage of financial services geographically. This will increase the opportunities for the population and small business entities to use banking services and create a solid foundation for the implementation of the state's strategic goals aimed at ensuring financial inclusion.

— Accelerating Privatization of State-Owned Banks: Gradually reducing the state's share in the banking sector (currently at 68% of assets) and stimulating private competition will improve the efficiency of resource allocation and drive innovation.

If these measures are implemented in a coordinated and consistent manner, Uzbekistan's banking system can emerge by 2030 not only as the most competitive and advanced in Central Asia, but also as a modern, digitally driven financial ecosystem capable of facilitating the country's integration into global financial markets.

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