

Digital Transformation of Banking Services in Uzbekistan: Efficiency Evaluation and Risk Management of Remote Channels

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Abstract. This article examines issues related to improving the practice of providing remote banking services by commercial banks of the Republic of Uzbekistan. The study generalizes the theoretical and methodological foundations of remote banking services and advanced foreign experience, develops a comprehensive four-dimensional methodology (financial, operational, customer, and risk/security) for assessing their efficiency, and conducts an empirical assessment based on the Data Envelopment Analysis (DEA) method, correlation-regression analysis, and trend analysis using the example of JSC “Turonbank.” Based on the findings, scientific and practical proposals have been developed for managing internet-banking risks, electronic document flow for import letters of credit, digital assessment of legal entities' creditworthiness, and remote overdraft lending based on debit cards for individuals; it is substantiated that the implementation of these proposals in practice has led to a significant improvement in a number of banking performance indicators.

Keywords: remote banking services, internet-banking, digital transformation, DEA method, credit risk, cybersecurity, electronic document flow, remote overdraft lending, financial inclusion.

INTRODUCTION

The rapid development of digital technologies in the global economy is fundamentally transforming the traditional model of banking service delivery: the center of gravity of service provision is shifting from branch networks to remote digital channels, with neobanks, payment organizations, and fintech platforms developing actively alongside banks. According to the Central Bank of the Republic of Uzbekistan,

the number of remote banking service users grew from 10.2 million as of January 1, 2020, to 82.9 million as of January 1, 2026 - an increase of more than eightfold; the number of bank plastic cards in circulation over the same period rose from 20.5 million to 68.3 million units, while the number of legal entities and individual entrepreneurs using remote services grew from 691 thousand to 1.7 million [1]. At the same time, problems such as insufficiently developed authentication systems for internet-banking and mobile-application transactions, the slow pace of electronic verification of import payment documents, limited capacity for digital assessment of legal entities' creditworthiness, and the absence of remote overdraft lending based on debit cards are leading to increased operational risk and declining customer trust.

This study is grounded in the banking and payments legislation of the Republic of Uzbekistan, in particular the Presidential Decree on the strategy for reforming the banking system [2], the Resolution on strengthening cybersecurity [3], and the Central Bank's Regulation on ensuring information security in remote financial services [4], and is consistent with the priority directions for the development of science and technology in the Republic of Uzbekistan.

The purpose of the study is to develop scientific proposals and practical recommendations aimed at improving the practice of providing remote banking services by commercial banks of the Republic of Uzbekistan. To achieve this purpose, the following tasks were set: generalizing the theoretical and methodological foundations of remote banking services and advanced foreign experience; identifying the composition, dynamics, and pressing problems of remote banking services in the country's commercial banks; assessing efficiency using DEA and other economic-statistical methods; substantiating ways to manage internet-banking risks; digitizing the flow of documents for import letters of credit; reducing legal entities' credit risk through digital assessment of creditworthiness; and introducing a remote overdraft lending system for individuals. The object of the study is the practice of providing remote banking services by commercial banks of the Republic of Uzbekistan, including JSC "Turonbank"; the subject is the financial relations that arise between commercial banks and their customers in the course of providing remote banking services.

LITERATURE REVIEW

An analysis of the degree of scholarly development of the problem shows that the theoretical and methodological aspects of remote banking services have been addressed

in the works of foreign economists - O.I. Lavrushin [10], V.M. Usoskin, N.D. Tkach, R.Yu. Moiseeva, L. Samsonova, G. Beloglazova, Yu. Yudenzov, and others - as well as in the studies of Uzbek scholars A.K. Mirsoatov, A.A. Azlarova, Z. Umarov, S.J. Gadoyev, S.S. Togayev, Z. Mamadiyarov, and others. The Technology Acceptance Model (TAM) [5], the theory of diffusion of innovations [6], and the SERVQUAL model of service quality assessment [7] serve as the theoretical basis for understanding customer acceptance of remote services, while efficiency assessment widely employs the DEA method founded by Charnes, Cooper, and Rhodes [8] and the Balanced Scorecard concept of Kaplan and Norton [9]. Nevertheless, although Z.T. Mamadiyarov has studied the general directions for developing remote banking services, issues such as the comprehensive assessment of efficiency using a four-dimensional criteria system, electronic document flow for import letters of credit, and remote overdraft lending based on debit card turnover have not yet been sufficiently studied by Uzbek scholars within a unified methodological approach - this defines the scientific novelty of the present study.

Systematizing the existing approaches to the concept of “remote banking services” made it possible to classify them as channel-technological, institutional-systemic, customer-oriented, innovation-competitive, and applied-systemic. It was shown that each type of service - PC-banking, internet-banking, mobile-banking, phone-banking, and ATM-banking - has its own distinct advantages and disadvantages. In shaping the risk/security dimension, the internationally used STRIDE (Microsoft), MITRE ATT&CK, CVSS (FIRST), and FAIR methodologies were reviewed as context, although in the present study the risk/security assessments were formed directly on the basis of the ISO/IEC 27001 and NIST CSF 2.0 standards and the requirements of the Central Bank's Regulation No. 35/14 [4].

RESEARCH METHODOLOGY

The study employed comparison and systematization, statistical and empirical analysis, SWOT analysis, grouping, expert evaluation, correlation-regression analysis, trend analysis, as well as Data Envelopment Analysis (DEA) [8] and the compound annual growth rate (CAGR) method, together with the construction of conceptual diagrams and models. The efficiency of remote banking services was assessed on the basis of a four-dimensional criteria system - financial (DEA, the financial perspective of the Balanced Scorecard [9]), operational (level of straight-through processing, system uptime), customer (Net Promoter Score, SERVQUAL, Customer Effort Score), and risk/security (extended CAMELS, ISO/IEC 27001, NIST CSF 2.0, and the

requirements of the Central Bank's Regulation No. 35/14 [4]). The two-stage integrated methodology developed for this purpose first forms the four-dimensional indicator system and then calculates relative efficiency using the DEA method. All calculations - correlation-regression, CAGR, and DEA coefficients - were performed in Microsoft Excel spreadsheets; the analysis was based on the official statistical and financial reports of the Central Bank of the Republic of Uzbekistan and commercial banks, analytical materials of international financial institutions, and the internal data of JSC "Turonbank." All volume indicators are presented in nominal terms, and the fact that changes in the price level (deflator) were not taken into account is noted separately as a methodological limitation of the analysis.

RESULTS AND ANALYSIS

The findings of the study are summarized in the two tables below, each followed by a detailed analysis.

Table 1

Dynamics of remote banking service indicators in the Republic of Uzbekistan [1]

Indicator	2020 (or beginning of period)	2025/2026 (or end of period)	Change
Number of remote banking service users	10.2 million (01.01.2020)	82.9 million (01.01.2026)	more than 8-fold
Number of bank plastic cards in circulation	20.5 million units	68.3 million units	3.3-fold
Number of legal entities and individual entrepreneurs using remote services	691 thousand	1.7 million	2.5-fold
Gross assets of the banking system	366.1 trln soums (2020)	892.9 trln soums (2025)	2.4-fold
Credit portfolio of the banking system	276.4 trln soums (2020)	602 trln soums (2025)	2.2-fold

Indicator	2020 (or beginning of period)	2025/2026 (or end of period)	Change
Payments made through the instant payment system	2021 level	2025 level	4.4-fold
Volume of QR-online transactions	2021 level	2025 level	32.8-fold
Number of IT-related crimes	863 (2019)	58,800 (2024)	68-fold

According to the data in Table 1, all segments of the remote payment infrastructure in the Republic of Uzbekistan - interbank and instant settlements, QR payments, mobile applications, and electronic money - showed steady and rapid growth in 2021–2025, with payments made through the instant payment system increasing 4.4-fold and QR-online transactions 32.8-fold. At the national level, the banking system's gross assets and credit portfolio grew 2.4-fold and 2.2-fold, respectively. An in-depth analysis using the example of JSC “Turonbank” revealed a strong inverse relationship between banks' growth rate and their initial size (Pearson coefficient $r \approx -0.85$), indicating that smaller banks are developing digital channels comparatively faster.

Efficiency assessment using the DEA method. As shown in Table 1, the assessment conducted on the basis of the four-dimensional criteria system and the DEA method placed JSC “Turonbank” third among ten leading banks with a coefficient of $\theta = 0.92$, while it led the sector on the risk/security dimension with a score of 90 points (against an industry average of 73.0 points) - confirming in practice that security indicators serve as a “precondition” for the remaining three dimensions. A strong correlation ($r = 0.98$) was also found between the level of digital service adoption and the DEA coefficient.

Prioritizing the problems. Consistent with the cybercrime dynamics shown in Table 2 (an increase from 863 to 58,800 cases, or 68-fold), the analysis identified five interrelated problems affecting the practice of remote banking services: cybercrime and authentication weaknesses, competitive pressure from digital banks, the lack of digitalization of electronic letters of credit, the traditional approach to credit scoring, and customers' low level of digital literacy. It was found that 98 percent of the identified crimes were related to bank cards, and 60 percent of cyberfraud cases were carried out through malicious links and software. Expert evaluation assigned the highest priority level (5.0 points) to the problem of cybercrime and authentication weakness.

Interrelation among the problems. The four identified problems were studied not as isolated phenomena but as a systemic chain stemming from common root causes. For this purpose, a three-stage conceptual model of “cause - problem - solution direction” was constructed, linking each problem to its root cause and the factor reinforcing it. The analysis revealed that the root causes of the first (authentication weakness) and fourth (underdeveloped remote overdraft lending) problems are closely related - both stem from gaps in control and authentication systems and mutually reinforce one another in practice - while the population's level of digital financial literacy and the extent of active bank-card usage act as a cross-cutting factor that equally reinforces all four problems. This substantiates the need for the proposed measures to address not each problem individually but also the common factors that reinforce them, simultaneously.

Table 2

Scientific and practical proposals implemented in the practice of JSC “Turonbank” and their results (2025 versus 2024) [11]

Direction	Proposed mechanism	Result achieved
Managing internet-banking risks	Improving transaction authentication, strengthening hardware-software control, and ensuring the integrity of transmitted data	Payment volume +11.4%
Document flow for import letters of credit	Electronic submission and verification of documents; ensuring the security of digital signature use	Electronic letters of credit volume +21.7%
Credit risk of legal entities	Assessing creditworthiness on the basis of digital technologies	Non-performing loan reserve –0.2 p.p.
Remote lending to individuals	Remote overdraft lending system based on debit cards	Online lending volume +4.7%
Efficiency assessment (DEA)	Four-dimensional criteria system (financial, operational, customer, risk/security) + DEA	$\theta = 0.92$; risk/security 90 points (industry avg. 73.0)

A comparative analysis of foreign experience shows that a study of the practices of South Korea, the United Kingdom, Singapore, India, and Kazakhstan identified three common factors behind successful international practices: an active role for the regulatory authority, the principle of technological interoperability, and the ecosystem integration of digital services with non-financial sectors. This trend is also confirmed by international statistics on financial inclusion [12]. The SWOT analysis conducted showed that Uzbekistan's commercial banks possess strengths such as a stable regulatory and legal framework and a young, technology-inclined population, while also revealing that an interbank interoperability standard has yet to be established. Practical results of the proposals. As shown in Table 2, the implementation of the four scientific and practical proposals in the practice of JSC “Turonbank” led to an 11.4 percent increase in internet-banking payment volume, a 21.7 percent increase in the volume of electronic import letters of credit, and a 4.7 percent increase in the volume of online lending to individuals, while the share of the non-performing loan reserve in gross assets decreased by 0.2 percentage points. The proposal for managing internet-banking risks is also reflected in the relevant Regulation approved by Resolution No. 35/14 of the Central Bank's Board, confirming the proposal's consistency with current legislation.

CONCLUSION

The study demonstrated that improving the efficiency of remote banking services is directly linked not only to the development of technological infrastructure but also to strengthening customer trust, raising digital financial literacy, and fostering a culture of cybersecurity. It is therefore advisable for commercial banks to widely adopt AI-based anti-fraud systems, biometric identification, and real-time monitoring systems, and to apply the proposed four-dimensional assessment criteria in their regular reporting practices.

At the same time, certain limitations of the results obtained are objectively acknowledged: first, the results have so far been confirmed only in the case of a single bank - JSC “Turonbank” - and applying them at other banks may require additional adaptation; second, since the results cover a single-year period (2025/2024), they reflect an initial effect rather than long-term sustainability; third, because the digital mechanisms introduced may themselves generate new types of risk (such as

algorithmic error risk in automated scoring models), their application must be accompanied by continuous monitoring.

Priority directions for the future development of remote banking services include the introduction of Open Banking standards, the formation of banking ecosystems, and the application of the proposed four-dimensional criteria system in banks' regular reporting practices. The creation of personalized banking products based on artificial intelligence and Big Data lies beyond the scope of this study and has been identified as a promising direction for future research. The complete theoretical and methodological foundations, calculations, and supplementary materials of the study are presented in detail in the author's PhD dissertation.

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