Digital Transformation and Corruption Risks: An Applied Economic Analysis of Kazakhstan's Banking Sector

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Abstract:

This paper examines the dual impact of digitalization on the banking sector from 2013 to 2024, using factor analysis and applied economic modelling to assess how digital tools, regulatory frameworks, and institutional performance interact in shaping financial crime dynamics. The results reveal that while digitalization improves operational efficiency and monitoring capacity, it also exposes structural weaknesses that facilitate illicit activities. Policy implications emphasize the need for robust regulation, strategic governance, cybersecurity investment, and capacity building to ensure that digitalization serves as a driver of innovation, trust, and financial stability. This study contributes empirical evidence to the applied economics literature on the complex role of digitalization in both enabling and mitigating corruption risks in emerging markets.

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Introduction

Digitalization has become a central driver of transformation in the global economy, reshaping industries, business models, and governance structures. In the financial sector, the integration of digital technologies has improved efficiency, broadened access to services, and strengthened data-driven decision-making. However, this process also carries unintended consequences, particularly in the domain of economic and financial crime. Emerging economies, where institutional capacity and regulatory oversight are still developing, face heightened risks of corruption, fraud, and money laundering in the digital environment.

The relationship between digital transformation and corruption is especially relevant for Kazakhstan. As one of the leading financial centers in Central Asia, Kazakhstan has implemented significant reforms in banking digitalization while also confronting persistent governance challenges. The tension between innovation and institutional vulnerability provides a unique context for studying how digitalization interacts with corruption risks.

This paper situates the analysis within the framework of applied economics, combining empirical evidence with institutional and policy perspectives. Using data from the National Bank of Kazakhstan and sectoral reports covering 2013–2024, we apply factor analysis to identify the key dimensions of digital transformation that influence corruption-related risks. Our findings highlight both the opportunities digitalization offers in combating financial crime and the new forms of vulnerability it creates in transitional economies.

Global experience (OECD, FATF, World Bank) shows that the lack of effective international instruments for controlling digital capital flows increases the risks of corruption and financial crime, which in turn threatens macroeconomic stability and sustainability of financial systems. In the context of globalization, digital corruption is becoming a transnational problem that requires coordination of efforts at the interstate level. Current studies (OECD, FATF, Transparency International) show that digital technologies, on the one hand, can serve as a tool for increasing transparency and control, and on the other hand, are used to conceal illegal transactions, increasing the threat to the financial security of states and undermining trust in international business.

The contribution of this study is twofold. First, it provides empirical evidence on the mechanisms through which digital transformation affects corruption risks in a key emerging market. Second, it derives policy recommendations for strengthening the resilience of financial systems against economic crime in the digital era. By bridging the gap between technological innovation and governance, this paper advances the discussion on how applied economic research can inform policy and practice in combating corruption.

1. Literature Review

Digitalization, on the one hand, opens up new opportunities for increasing the efficiency, transparency and accessibility of financial services, and on the other hand, it creates new threats: cybercrime, the growth of online fraud, the use of cryptocurrencies for money laundering, corruption schemes in international transactions and vulnerabilities in the digital security system of banks. In Kazakhstan, as in many other countries, the process of digitalization of the banking sector is accompanied by a contradiction: the accelerated implementation of innovations goes hand in hand with the growth of risks that are not yet fully controlled by existing regulatory mechanisms. At its core, digital transformation implies changes at two levels: first, in the core of the organization, its processes and routines; second, in its environment, business models, products and services, as well as in the interaction between users and the organization itself (Hanelt et al., 2021; Mergel, et al., 2019).

The main trigger for these changes is the introduction of digital technologies, which are changing the expectations of citizens and users regarding the delivery of public services (e.g., seamless service delivery, improved usability) and introducing new ways of delivering services. Although many governments have not achieved their goal of digitizing all public services and administrative processes, there has been an increasing use of new digital technologies, which has led to significant changes in public sector organizations (Enang, et al., 2020; Gil-Garcia et al., 2018; Hinings, et al., 2018).

The process of implementing digital changes involves interdepartmental cooperation and interaction with external stakeholders. The role of digitalization in the banking sector of Kazakhstan is increasing under the influence of a number of challenges, such as: competition in the banking sector, the growth of the Kazakh economy, an increase in services in the banking sector, the need to maintain strategic advantages, etc. (Kirdasinova et al., 2021). The global financial and economic crisis of 2008 had a great impact on the banking sector of Kazakhstan, prompting the state to tighten regulation (Kodasheva et al., 2017), and commercial banks to develop risk management policies using new technologies, including digital ones (Sadvokassova et al., 2020; Delice & Karadaş, 2022). Digitalization has a positive impact on the implementation of the operating model and new approaches to working with clients, especially given the large territory of the country and low population density (Shustova & Blagoev, 2018). Characteristic features of the digitalization of the banking sector of Kazakhstan are: minimization of cyber threats, the introduction of artificial intelligence technologies in the banking sector and a focus on remote customer service (Gumar et al., 2023). Digital technologies can significantly reduce banks' operating costs and increase efficiency, but require a serious approach to managing new types of risks (Aguayo & Ślusarczyk, 2020). These findings are also confirmed in their study by Cocco et al. (2017), while noting, like other researchers, blockchain technology as one of the factors reducing costs and increasing security in banking operations (Shanti & Elessa, 2022). In addition to digital security, modern banks may also face other risks in the process of digitalization, such as operational vulnerabilities, maintaining customer privacy, increasing online fraud, etc. (Chen et al., 2023; van Zeeland & Pierson, 2024). Globalization, increasing regulation and the increasing role of FinTech companies encourage the banking sector to pay special attention to reducing barriers to the implementation of digitalization (Boot et al., 2020; Ulrich-Diener et al., 2023).

Digitalization helps reduce systemic risks in banks (Fang et al., 2023; Hoque et al., 2024). With a complex digitalization system, the systemic risks of banks increase. The degree of risks may vary depending on the characteristics of banks, so regional banks are exposed to more risks than large state-owned and joint-stock banks (Zhang et al., 2023). The COVID-19 pandemic has had a major impact on macroeconomic stability and increased global risks for the banking sector, but at the same time accelerated digitalization processes (Doran et al., 2022; Huang et al., 2023; Bueno et al., 2024). According to the author, the key problem is that the pace of digitalization is outpacing the pace of adaptation of legal and institutional regulation, especially in transnational business. This creates "grey areas" where digital technologies are used not only to optimize processes, but also to circumvent legislation and legalize corruption schemes. In international business, digitalization often leads to the transformation of classic corruption into a digital form - through manipulation of blockchain platforms, offshore digital services and cryptocurrency transactions.

To effectively mitigate the adverse implications of digitalization, a two-tier governance framework should be implemented. At the national level, governments must establish robust digital compliance mechanisms, adopt artificial intelligence–driven transaction monitoring systems, and strengthen the supervisory authority of central banks and financial regulators. At the international level, policymakers should pursue the harmonization of regulatory frameworks through institutions such as the OECD, FATF, and G20, develop joint databases to track digital crimes, and formulate binding global standards of digital transparency.

Thus, digitalization itself does not inherently generate corruption or financial misconduct; however, in the absence of comprehensive regulatory safeguards, it risks becoming a catalyst for new and more complex forms of economic and financial crime.

2. Research Methods and Design

The methodological basis of the study is grounded in a systemic and interdisciplinary approach, integrating applied economics, institutional theory, and criminological perspectives. This framework allows for the examination of both the structural dynamics of digitalization in the banking sector and the institutional vulnerabilities that facilitate economic crime.

To achieve the research objectives, the study employs four interrelated methodological clusters:

1. Factor analysis, supported by correlation and regression techniques, was applied to identify latent structures linking banking sector digitalization with corruption-related risks. This approach captures both the strength and direction of relationships between digital adoption, financial indicators, and manifestations of economic crime.

2. Kazakhstan's trends were benchmarked against international experience (EU, USA, CIS countries) to distinguish general patterns from country-specific features. In addition, content analysis of international regulations and reports (FATF, World Bank, Transparency International) provided insights into global practices in combating financial crime in the context of digitalization.

3. The historical-logical method was used to trace the evolution of Kazakhstan's financial system, emphasizing the stages of digital technology implementation and their criminogenic implications. This was complemented by institutional theories of corruption and transaction cost analysis to interpret the interaction between digital innovation and governance weaknesses.

4. Scenario analysis was employed to forecast potential trajectories of digital transformation in the banking sector and their associated corruption risks, allowing for policy-relevant insights into the balance between innovation and regulatory capacity.

This methodological framework ensures a comprehensive analysis by combining statistical patterns and econometric modelling with institutional interpretation and international comparison.

This study adopts an applied economics approach to assess how digital transformation influences corruption risks in Kazakhstan's banking sector. The design integrates descriptive statistics, econometric modelling, and institutional analysis, allowing for both structural and behavioural dimensions of digital banking to be examined. The empirical framework combines factor analysis with regression techniques to identify latent dimensions of digitalization and assess their association with corruption-related vulnerabilities. The methodology is structured to capture (i) the systemic drivers of digital banking development, (ii) the institutional weaknesses that exacerbate economic crime, and (iii) the interaction between innovation and regulatory capacity.

Variables

- Dependent Variable: Corruption/Financial Crime Risk Index (CFRI), constructed from indicators of fraud cases, money laundering investigations, and regulatory violations.
- Independent Variables: Digital Adoption (share of online/mobile transactions), Regulatory Capacity (supervisory inspections, compliance actions), Institutional Quality (governance and control of corruption indices), Financial Transparency (disclosure requirements, auditing standards), Economic Scale (GDP per capita growth, banking assets relative to GDP).

Analytical Method: Factor Analysis

Factor analysis was employed to reduce dimensionality while preserving underlying relationships among indicators. Principal component analysis with varimax rotation was applied, retaining factors with eigenvalues greater than 1.0. Model adequacy was confirmed via the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. Factor scores were then used to construct indices linking digitalization trends to corruption risks.
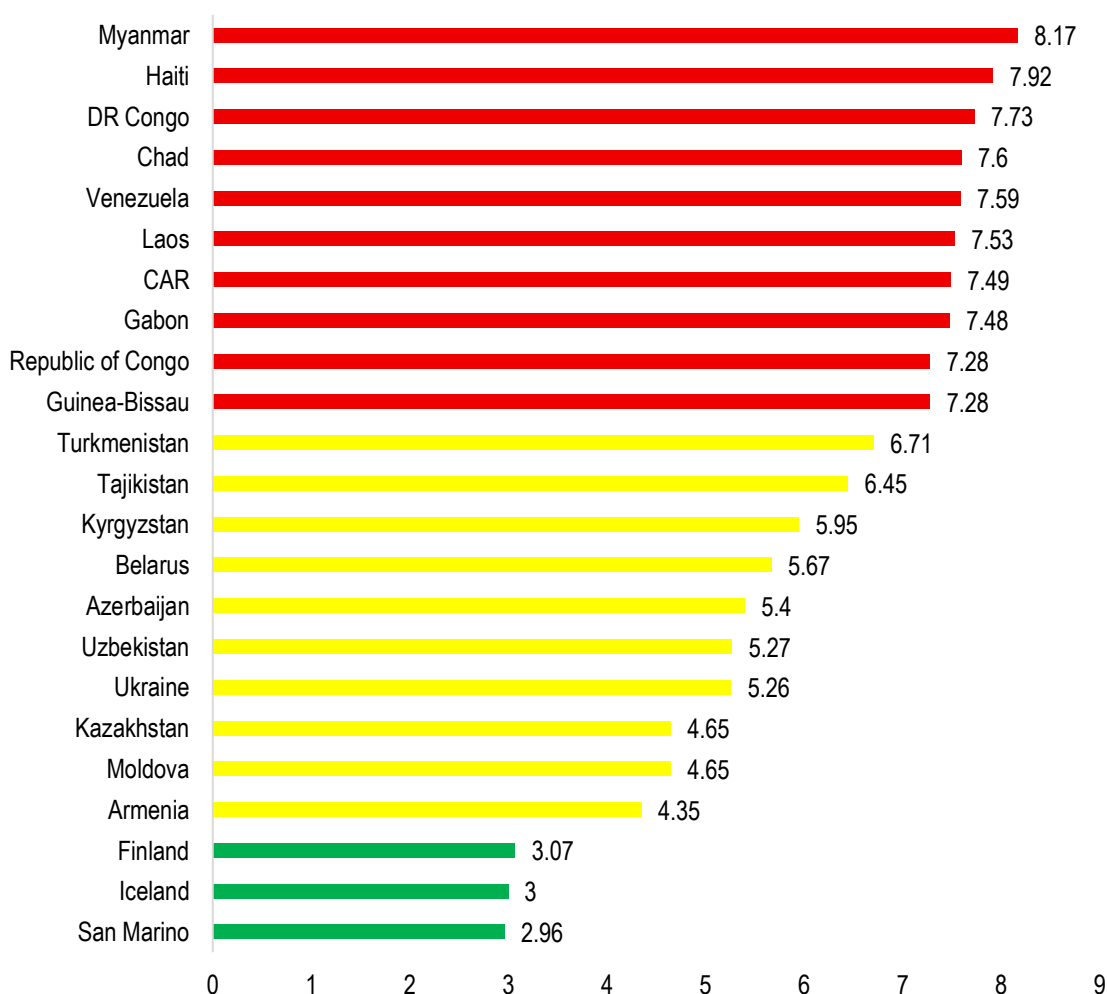
The constructed indices offer several analytical insights. First, they illustrate how digital transformation can reduce transaction costs and alleviate information asymmetries, thereby enhancing operational efficiency. Second, they highlight that institutional weaknesses may exacerbate corruption risks, even in the presence of advanced technological adoption. Finally, the indices underscore the inherent policy trade-offs between promoting innovation and ensuring effective governance, emphasizing the need for balanced regulatory strategies that simultaneously support digital development and mitigate associated risks.

The analysis is constrained by data availability and consistency, particularly in cross-country comparisons. Factor analysis reveals correlations rather than causal effects; therefore, findings should be interpreted as indicative and subject to further econometric validation.

3. Mapping Financial Crime Risks in a Digitalized Kazakhstan

Kazakhstan has made notable progress in combating financial crime. In the Anti-Money Laundering Index for 2024, the country ranked 111th out of 164, a positive development given that the index is ranked from worst to best. The Republic of Kazakhstan's score was 4.65, improving from 4.71 at the end of 2023 (Figure 1). The index measures a country's vulnerability to money laundering and related financial crimes, as well as its ability to counter them, though it does not quantify the actual volume of illicit transactions.

Figure 1: Anti-money laundering index rankings, 2024

Source: Compiled by the authors, https://dknews.kz/ru/finansy/361312-kazakhstan-pokazal-progress-v-borbe-s-finansovymi

Within the CIS region, Kazakhstan performed well, trailing only Armenia (129th) and Moldova (112th). The worst performers included Turkmenistan (23rd), Tajikistan (30th), and Kyrgyzstan (45th). Other countries performed moderately: Belarus (53rd), Azerbaijan (74th), Uzbekistan (81st), and Ukraine (82nd). Globally, the lowest-ranked countries were Myanmar, Haiti, and the Democratic Republic of the Congo, while the best performers were San Marino, Iceland, and Finland.

Regionally within Kazakhstan, criminal offenses related to money laundering increased in some areas. Astana recorded 9 cases (up from 2 the previous year), Shymkent 8 cases (up from 3), Almaty city 7 cases (up from 4), and Karaganda 5 cases (up from 1) (Figure 2). Over the period 2022–2024, overall trends indicate a worsening situation in certain regions.

Figure 2. Criminal offenses related to money laundering, Kazakhstan, by region
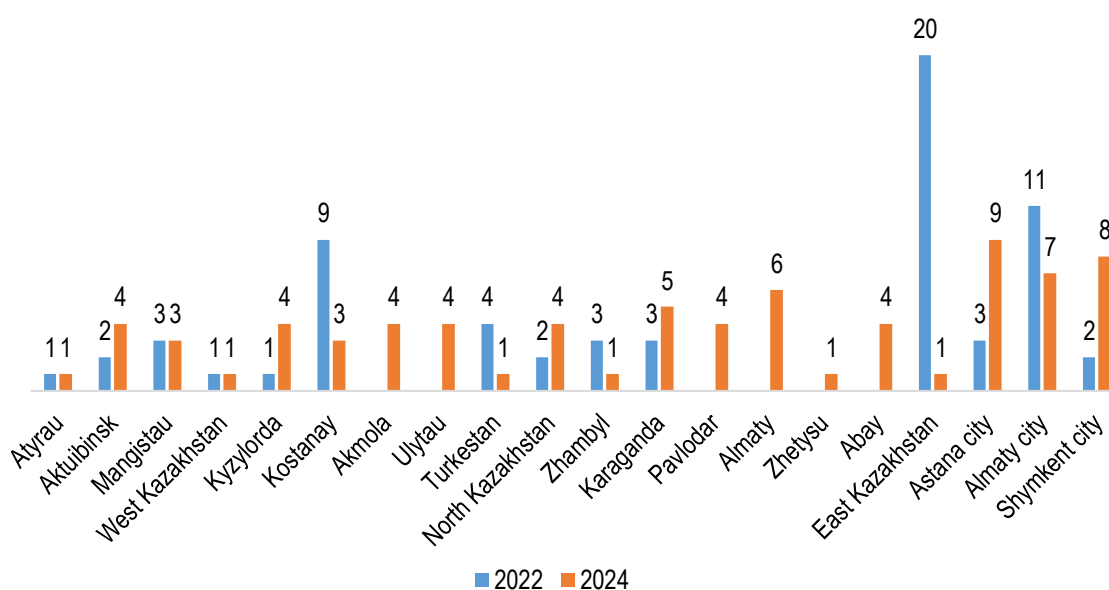
Source: Compiled by the authors based on *https://dknews.kz/ru/finansy/361312-kazahstan-pokazal-progress-v-borbe-s-finansovymi*

Figure 3 presents a dendrogram illustrating the clustering of regions by the number of criminal offenses related to the legalization of criminal proceeds for 2022–2024. The analysis highlights several key insights:

- Clustering of regions by offense dynamics:
  o Regions with similar trends in case growth or decline are grouped together.
  o Some clusters reflect stable low-level offenses (e.g., West Kazakhstan, Atyrau), while others show sudden increases (Astana, Almaty, Shymkent).
  o Anomalies such as East Kazakhstan (20 → 1 case) may reflect either genuine improvement or the "masking" of crimes.
- Digitalization and the nature of financial crime:
  o Criminal schemes are increasingly moving online, including cryptocurrency cash-outs, cross-border transactions, and offshore platforms.
  o Regions with high digital activity (Astana, Almaty, Shymkent) show an increase in offenses, reflecting:
    ▪ Development of banking and FinTech services,
    ▪ Expansion of the digital economy,
    ▪ Emergence of new corruption channels.
  o Digitalization also provides tools for control, such as transaction monitoring, automated AML systems, and AI-based anomaly detection.
- Impact on international business and corruption:

- ○ High digitalization increases transparency through electronic document management, blockchain, and digital footprints.
- ○ Conversely, it raises risks of financial corruption, as digital channels can facilitate money laundering and transnational schemes.

Thus, the dendrogram provides a "geography of risks," identifying problem clusters and supporting targeted digital control measures.

Figure 3: Dendrogram of criminal offenses on legalization of proceeds from crime in Kazakhstan (2022–2024)
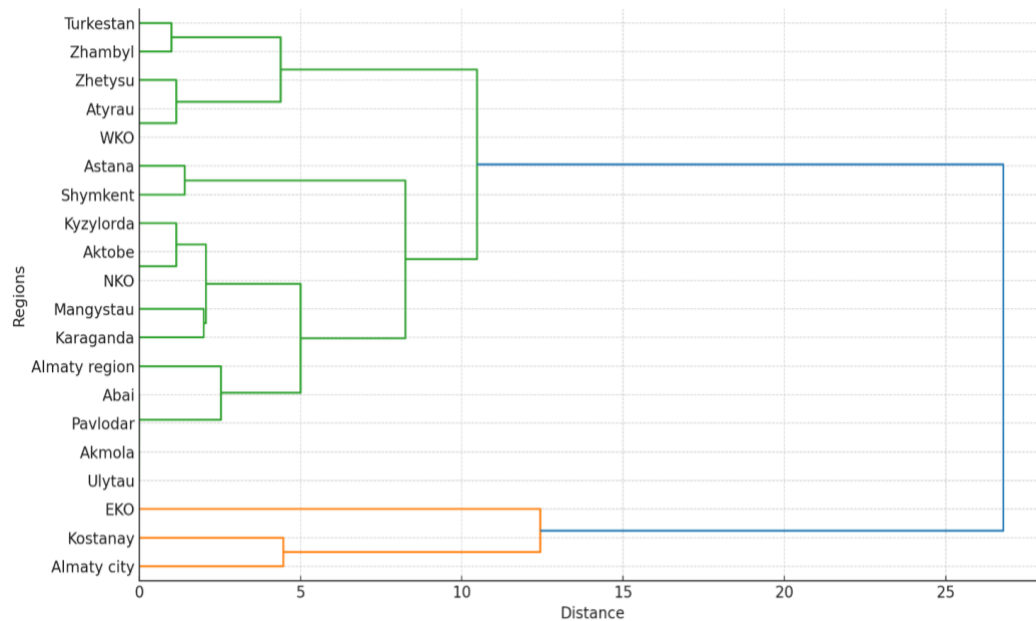
Source: Compiled by the authors

Figure 4 illustrates a typical scheme for the withdrawal of assets from a credit institution using securities. Criminal structures use banks and shell companies to legalize assets, disguise their source, and transfer funds abroad.

Figure 4: Withdrawal of assets of a credit institution using securities
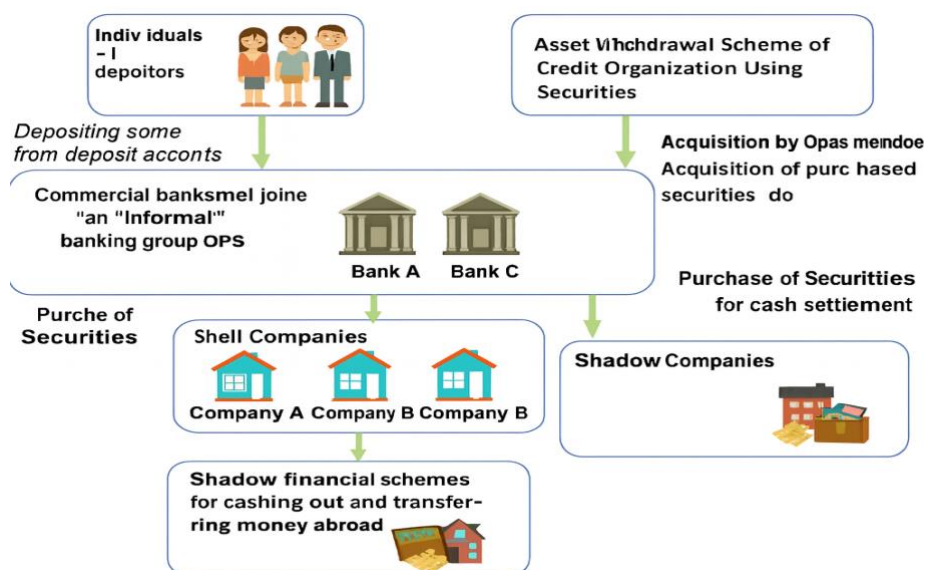
Source: Compiled by the authors

The analysis highlights several key insights for policy and strategic planning. Regional risk prioritization is essential, as clustering identifies high-risk areas such as Astana, Almaty, and Shymkent, which require targeted monitoring and enhanced anti-corruption digital controls. Digitalization functions as a dual-edged tool: while it promotes transparency and operational efficiency, digital channels can also create new avenues for financial crime, emphasizing the need for integrated AML and cybersecurity measures. An institutional and regulatory focus remains critical, including strengthening regulatory capacity, improving governance, and fostering cross-border cooperation to mitigate corruption risks that are amplified by technological adoption. Finally, evidence-based planning benefits from the "geography of risks" derived from the dendrogram, which can guide resource allocation, inform policy development, and support the design of preventive measures in both banking and digital financial services.

4. Modelling of Financial Crime Risks in the Banking Sector

Mathematical and statistical modelling provides essential tools for understanding the patterns of criminal money laundering and informing effective prevention strategies. The analysis demonstrates that digitalization alone does not reduce financial crime; it must be complemented by the development of cybersecurity measures, anti-corruption digital tools, and international cooperation to mitigate associated risks. Integrating mathematical models into the assessment and management of money laundering risks helps create a more resilient and sustainable economic system protected from illicit financial activity.

A factor analysis was conducted to identify the internal relationships among indicators characterizing the development of Kazakhstan's banking sector. This method enables the detection of latent variables that influence the observed indicators, grouping them into factors according to their relative significance. The study utilized key macroeconomic and financial indicators from 2013 to 2024, including loans to the economy, assets, loan portfolio, overdue loans, liabilities, equity, ICT expenditures, digital technology costs, operating expenses, and banking sector profits (Table 1). The results of the factor analysis are presented in Table 2.

Table 1: Dynamics of the considered indicators for 2013-2024, million KZT

Year	Loans to the Economy	Assets	Loan portfolio	Loans with overdue payments	Liabilities
2013	11,314,974	15,462,749	13,348,171	4,601,815	13,380,304
2014	12,165,954	18,239,256	14,184,814	3,925,558	15,879,573
2015	12,844,824	23,784,427	15,553,712	2,117,013	21,289,941
2016	12,519,878	25,561,157	15,510,812	1,897,715	22,716,298
2017	12,544,312	24,220,516	13,590,511	1,989,785	21,129,479
2018	12,469,986	25,240,959	13,762,741	1,996,417	22,223,404
2019	13,673,974	26,804,963	14,743,023	1,806,205	23,165,493
2020	14,594,526	31,172,379	15,792,064	1,528,729	27,217,147
2021	18,502,803	37,622,022	20,200,355	1,063,823	33,087,077
2022	22,774,137	44,562,328	24,254,661	2,996,647	39,334,637
2023	27,860,691	51,441,097	29,853,710	3,270,933	44,579,098
2024	31,923,204	58 458,813	33,755,189	4,466,326	50,010,796
Year	ICT costs	Banking Digital Tech Costs	Banking Operating Expenses	Banking sector profit	Equity capital
2013	220,848	120,175	162,334	264,871	2,082,445
2014	237,079	145,908	192,699	280,027	2,359,682
2015	375,600	126,845	207,036	227,018	2,494,486

Year	ICT costs	Banking Digital Tech Costs	Banking Operating Expenses	Banking sector profit	Equity capital
2016	269,527	150,904	230,242	401,846	2,844,859
2017	349,944	168,776	230,258	-18,672	3,091,036
2018	305,217	156,961	241,390	638,389	3,017,554
2019	337,713	168,146	264,193	802,995	3,639,470
2020	388,929	174,619	287,281	726,803	3,955,231
2021	443,121	206,708	321,064	1,289,327	4,534,944
2022	589,853	220,607	371,679	1,466,545	5,227,690
2023	918,350	274,397	471,621	2,184,757	6,861,999
2024	918,350	289,856	471,934	2,854,416	8,448,016

Source: compiled by the authors according to https://www.nationalbank.kz

Table 2: Results of factor analysis

	y	X1	X2	X3	X4
y		0,995430568	0,99970596	0,9052706	0,991819
X1			0,99583577	0,88130175	0,999114
X2				0,89519234	0,992624
X3					0,870386
X4					
	X5	X6	X7	X8	X9
y	0,973193462	0,991312642	0,982179	0,98322284	-0,94464
X1	0,960068198	0,984211741	0,975737	0,97244863	-0,93015
X2	0,974195156	0,993524773	0,984115	0,98477177	0,981407
X3	0,885078348	0,862188121	0,870492	0,88946714	0,913158
X4	0,954183427	0,979569787	0,973235	0,96311762	0,961932
X5		0,984232001	0,995642	0,95370258	0,961571
X6			0,990255	0,98368969	0,978064
X7				0,95526397	0,958032
X8					0,992600
X9					

Source: compiled by the authors

The analysis shows that digitalization generally has a positive effect on banking sector efficiency, particularly through loans, assets, capital, and ICT spending. However, a critical risk factor (X9) associated with financial crime and corruption emerged. Most factors (X1–X8) showed strong positive correlations with the performance indicator (Y), indicating that loans, assets, capital, and digital spending significantly contribute to sectoral performance. In contrast, X9 displayed a strong negative correlation with Y (-0.94), highlighting that increases in overdue loans or shadow spending undermine efficiency and amplify risks. Factors with the highest loadings (X1, X2, X4, X6) represent the main drivers of sector performance, while X5, X7, and X8 also contribute strongly but less stably. X3, although moderately correlated, remains significant.

Factor clusters reveal that positive driver (X1–X8) support digitalization, asset growth, profit generation, and operational improvements, whereas the negative factor (X9) reflects increased corruption and financial crime risks. The factor analysis demonstrates a dual effect of digitalization: while it enhances growth and efficiency, it simultaneously introduces vulnerabilities that form part of the "dark side of corruption" in international business. Specifically, increased ICT costs correlate with the emergence of new economic and financial crime schemes, highlighting the trade-off between digital efficiency and digital vulnerability.

The factor analysis allowed the dimensionality of the data to be reduced, the structure of relationships between digitalization, financial stability, and banking risks to be determined, and factor loadings to be constructed to quantify the influence of each indicator (Table 3 and Figure 5). Factor 1 (financial and digital base) shows strong loadings on loans, assets, capital, ICT expenses, and profits, reflecting overall sector growth and digitalization. Factor 2 (loan portfolio quality) is moderately negatively loaded on overdue loans, indicating credit risk. Factor 3 highlights overdue loans as an independent risk factor affecting liquidity and financial stability.

Table 3: Factor loadings for indicators for 2013–2024

Indicator	Factor 1	Factor 2	Factor 3
Credits to the economy	0,977	-0,123	-0,176
Assets	1,000	0,003	0,000
Loan portfolio	0,967	-0,101	-0,223
Overdue loans	0,172	-0,551	-0,749
Obligations	0,999	0,034	0,000
Equity	0,983	-0,185	0,000
ICT costs	0,959	-0,115	-0,146
Digital spending	0,975	-0,134	-0,001
Operating expenses	0,989	-0,042	0,008
Profit	0,960	-0,173	-0,084

Figure 5: Graphical factor loadings for indicators for 2013–2024
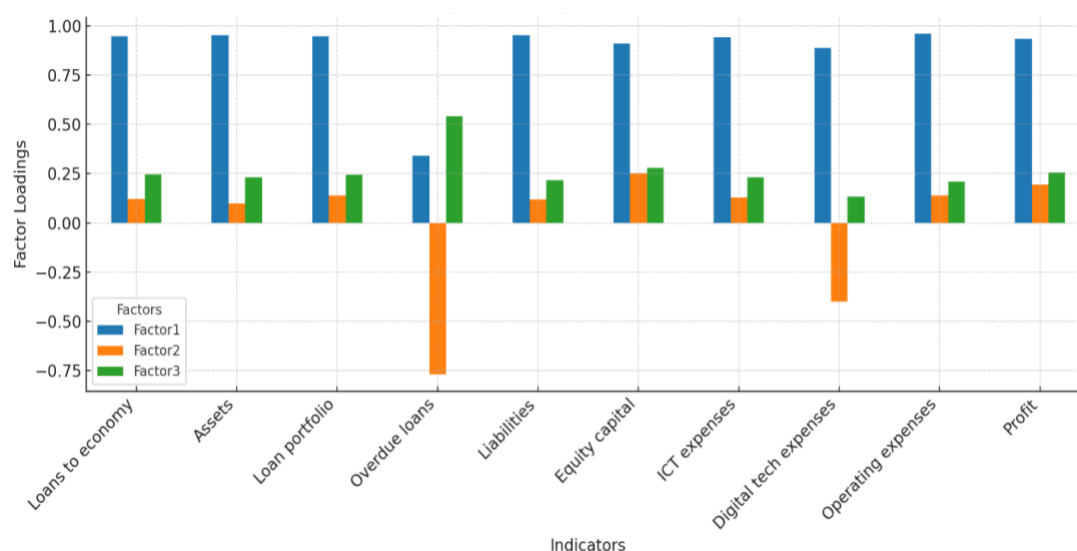
Source: Compiled by the author based on calculations made

These factors directly correlate with digitalization-related risks: digital technologies reduce transaction costs and increase efficiency, but also open new channels for financial crime and corruption, such as asset withdrawals via digital schemes or securities transactions. Increased ICT and digitalization costs (Factor 1 and Factor 3) reduce transaction costs but raise the likelihood of online fraud and money laundering. High levels of non-performing loans (Factor 2) indicate risk areas where digitalization may be exploited to disguise losses or extract assets. The growth of assets and liabilities further enables new corruption schemes, including fictitious digital transactions, ICOs, and cryptocurrency transfers.

The relationship diagram (Figure 6) summarizes the impact of digitalization on banking efficiency and vulnerabilities, linking factor analysis results to risks of corruption and financial crime. Overall, factor analysis provides a nuanced understanding of digital transformation in the banking sector, identifying positive effects such as capital growth, increased profits, and cost optimization, alongside potential threats including rising credit risks, operational vulnerabilities, and expanded opportunities for financial crime. These findings underscore the need for practical measures to mitigate risks and ensure the sustainable development of digital banking in Kazakhstan.

Figure 6. Impact of digitalization on the efficiency and vulnerabilities of the banking sector
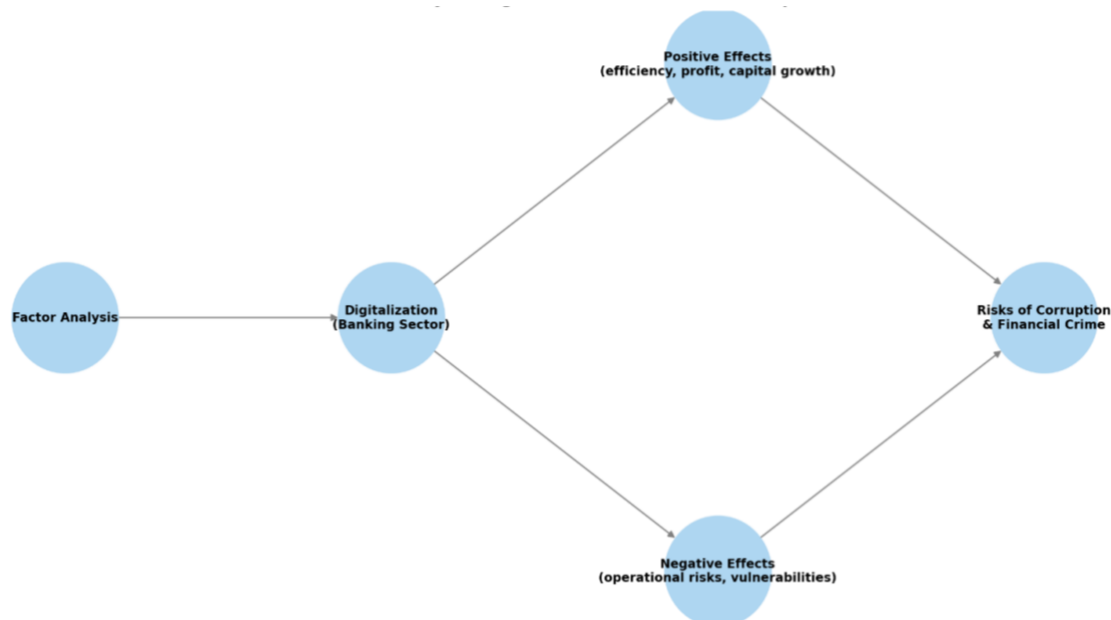
Source: compiled by the authors

Thus, factor analysis serves as a tool for a deeper understanding of the digital transformation processes in the banking sector, identifying its positive effects (capital growth, increased profits, cost optimization) and potential threats (increased credit risks, operational vulnerabilities, increased opportunities for economic and financial crime). The results of the study revealed both the positive effects of digitalization for the development of the financial sector and significant risks associated with the growth of cybercrime, money laundering schemes and increased corruption practices in international business. In this regard, the development of a set of practical measures aimed at reducing threats and ensuring the sustainability of the digital transformation of the banking sector is particularly relevant.

Conclusion

The analysis demonstrates that the digitalization of Kazakhstan's banking sector is a dual-faceted process, presenting both significant opportunities and notable challenges. On one hand, digitalization enhances operational efficiency, streamlines financial services, improves customer experience, reduces operational costs, and supports profitability and competitiveness among banks. On the other hand, it creates new risks, including cybercrime, fraud, money laundering, and cross-border corruption, highlighting the growing complexity of managing digital financial systems.

Digitalization is fundamentally a neutral tool; its impact depends largely on the quality of regulation, the robustness of cybersecurity frameworks, and the preparedness of both the state and society to manage emerging risks. When implemented in a controlled and strategic manner, digitalization can act as a powerful driver for the development of the financial system. Conversely, its uncontrolled or poorly regulated adoption may exacerbate the shadow economy and erode public trust in financial institutions.

The study highlights several important patterns:

- Adoption of digital technologies and ICT in banking correlates with higher profitability and competitiveness, driven by improved efficiency and reduced transaction costs.
- Growth in digital banking activity is associated with increased exposure to financial risks, including cyber threats, fraud, and money laundering.
- Implementation of digital risk management tools helps reduce problem loans by improving oversight of borrower solvency.
- Digitalization of cross-border financial processes can amplify corruption and financial crime risks, as global transactions and digital channels facilitate asset transfers beyond national jurisdiction.

Overall, the findings underscore that while digitalization is a transformative force in Kazakhstan's banking sector, its benefits are realized and its risks mitigated only through robust regulation, advanced cybersecurity measures, and strategic governance. Properly guided, digitalization can strengthen financial stability, enhance transparency, and promote sustainable growth in the sector.

From a policy perspective, these results suggest that authorities should prioritize the development of comprehensive regulatory frameworks, invest in cybersecurity infrastructure, and promote public-private partnerships to enhance digital literacy and risk management capabilities. Banks, in turn, should adopt a proactive approach to monitoring emerging threats, integrating advanced digital risk management tools, and fostering a culture of compliance and transparency. Such coordinated efforts can ensure that digitalization serves as a driver of innovation and trust, rather than a source of vulnerability, within the financial system.

Credit Authorship Contribution Statement

Omarova, A. contributed to the conceptualization, methodology, analysis, and drafting of the manuscript. Kussainova, L., as corresponding author, supervised the research, and contributed to validation and final editing. Malakhov, D. handled data curation and visualization. Mabiyeb, Ye. contributed to investigation, resources, and manuscript revision. Kenzhebekov, R. supported the literature review, validation, and editing.

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Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. It is noted that Omarova, A. the publisher manager, is author of this paper. However, this position did not influence the editorial decision-making process. The manuscript was subject to independent peer review handled by a qualified editorial team member with no competing interests.

Data Availability Statement

The data that support the findings of this study were obtained from the following publicly available sources: National Bank of Kazakhstan – financial sector indicators and digital banking adoption rates: https://nationalbank.kz; Agency for Regulation and Development of the Financial Market: https://www.gov.kz/memleket/entities/ardfm; World Bank, Worldwide Governance Indicators (WGI): https://info.worldbank.org/governance/wgi; Transparency International, Corruption Perceptions Index (CPI): https://www.transparency.org/en/cpi; Financial Action Task Force (FATF) reports: https://www.fatf-gafi.org. These third-party data are available at the respective institutional websites, subject to access policies. Processed datasets generated during the study are available from the corresponding author upon reasonable request.

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