

THE IMPACT MECHANISM OF INNOVATIVE CREDIT STRUCTURE AND DIGITAL TRANSFORMATION OF THE BANKING SYSTEM

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Abstract

Modern in the economy digital technologies all fundamental changes in industries, especially in the banking sector take is coming. Digital transformation banks expenses reduce and credit the risk management efficiency in increasing important factor as increasingly confession is being done. This with together, this transformation to banks market in the conditions to changes more flexibility gives and credit size and structure further effective to be opportunity creates. This advantages widely recognized although, in practice scientific in literature digital bank loan of transformation to operations how impact to show deep analysis This has not been done. analysis and studies exactly this the gap to fill aimed at is digital bank loan of transformation to supply how dynamic impact to show learns. This in the article commerce in banks digital development acceleration and small and middle business supportive credit strategies to strengthen related theoretical the basics analysis will reach.

Keywords

digital transformation, innovative credit structure, commercial bank loans, convergence of the digital economy and the real economy.

Introduction.

In the current context of globalization and technological development, the formation of an innovative credit structure of the banking system and the acceleration of digital transformation are becoming one of the important factors of economic growth. Digital transformation in the banking sector today is of great importance in improving customer service, automating operations, reducing costs and increasing competitiveness. Commercial banks are not only increasing the efficiency of services through digitalization, but also gaining market dominance through new innovative solutions.

The Republic of Uzbekistan is also implementing large-scale reforms aimed at modernizing the banking and financial sector and expanding the scope of digital services. In particular, the Decree of the President of the Republic No. PF-5953 dated 02.03.2020 "On the State Program for the Implementation of the Strategy of Actions in Five Priority Areas of Development of the Republic of Uzbekistan in 2017-2021 in the "Year of Science, Education and Digital Economy Development" [1] sets the goal of ensuring the financial stability of banks, wide introduction of modern information and communication technologies and improving the quality of services, as well as the development of innovative credit products and new banking services as a priority, which has served as a significant factor in the formation of an innovative credit structure of the banking system and accelerating digital transformation over the past years. In addition, the Decree of the President of the Republic of Uzbekistan No. PF-76 dated May 24, 2023 "On measures for the effective organization of public administration in the field of digital technologies within the framework of administrative reforms" [2] established the acceleration of digital transformation processes and the widespread introduction of innovative solutions in all sectors of the economy, in particular in the banking sector. Based on this Decree, it is aimed to increase the share of digital services in the banking and financial system, develop online lending systems, and introduce modern financial technologies.

International experience also shows how important digital transformation is for the banking system. For example, according to the 2022 White Paper on the Development of China's Digital Economy, in 2021, the size of China's digital economy reached 45.5 trillion yuan, accounting for 39.8% of the country's gross domestic product (GDP), ranking second in the world. The rapid development of the digital economy is creating favorable conditions for the digital transformation of commercial banks. Banks exchange information with various departments through digital solutions, thereby reducing the cost of obtaining information [3]. Financial technologies allow banks to more deeply analyze the financial and operational status of real sector enterprises, making it easier for innovative companies to obtain loans [4].

As can be seen from the above, digital transformation in the banking sector is of great importance today in improving customer service, automating operations, reducing costs, and increasing competitiveness. Commercial banks are not only increasing the efficiency of services through digitalization, but also gaining market dominance through new innovative solutions. Therefore, considerations aimed at the widespread implementation and in-depth analysis of digital transformation in the commercial banking sector are of great importance today.

Analysis of literature on the topic.

The digital transformation of commercial banks has attracted considerable academic interest, and various methodologies have been used to study its impact. The most widely used are panel data and multidimensional indices that include cognition, organizational structure, and product innovation. For example, Chen [5] and Khattak [6] analyzed the impact of digital transformation on risk and financial stability using data from listed banks. Jia and Liu [7] examined the broader implications of digital banking, focusing on systemic risks. The indices developed to measure digital transformation mainly cover technological adoption, digital product innovation, and organizational change. Zhu and Jin [8] and Shanti [9] used fixed effects regression analysis to determine the impact of digital transformation on bank efficiency and profitability. According to their research, indicators such as customer service, internal processes and service innovation are measured by a composite index. The success of the digital transformation process in banks is significantly affected by the role of management, openness to innovation and the level of technical knowledge. In addition, the level of interbank competition and the general business environment also determine the extent to which digital transformation helps companies reduce their dependence on bank credit.

Similarly, Hou and Yang [10] found a bidirectional relationship between digital transformation and liquidity mismatch, showing that digital technologies enhance banks' ability to manage credit risks. Many studies use panel data and composite indices to examine the complex effects of digital transformation, and find that governance and market conditions significantly affect the final results. Importantly, digital transformation expands financing opportunities for companies and reduces their dependence on traditional bank lending.

The digital transformation of commercial banks is emerging as a result of the integration of advanced technologies and financial innovations. State-supported public guarantee programs are also driving the mandatory digital transformation of banks by encouraging the digital development of state service platforms. Many economic literatures cite the potential of digital innovation to improve the efficiency of banking operations, reduce costs, and expand access to credit.

In their research, YINikonova and AGIvasenko studied the process of digital transformation of the Russian financial sector. The authors emphasize that new approaches to providing financial services are being formed through the introduction of digital technologies and, since their research has shown a positive impact of digital transformation on the efficiency of financial companies, they



propose to digitize the banking system [11]. A. Golubev, O. Ryabov and A. Zolotarev in their article [12] analyzed the process of digital transformation in the Russian banking system through the introduction of blockchain and artificial intelligence technologies. The authors emphasize the need to introduce advanced technologies to increase the competitiveness of small and medium-sized banks. L. Votintseva, M. Andreeva, I. Kovalenin and R. Votintsev [13] conduct a study on the assessment and prospects of digital transformation of Russian banking institutions. Based on the results of their research, the authors discuss the problems that arise in the process of transition to a digital banking model and ways to solve them. In the article by KA Khudayarova [14], the practice of digital transformation of commercial banks in Uzbekistan is studied. The author emphasizes that through digital modernization, banks have the opportunity to meet the needs of customers and increase their loyalty. In her study, GKMamedova [15] analyzed the changes that have occurred as a result of the introduction of digital technologies in the banking sector of Uzbekistan. The author proposed the practical application of digital financial services to traditional banking services and increasing financial inclusion.

Research methodology.

This in the banking system in the article innovative credit structures and digital transformation economic efficiency studied . Digital transformation in banking the impact measurement for special composite index working to be released attention focused . Innovative credit of products efficiency indicators mutual dependency and regression analysis using assessed , fixed and random effects models using panel data based on economic results analysis was done . In the study interbank differences and time according to trends determination panel regression for methods usage , digital technologies current done and current immature banks between comparison analysis conducted , statistics and hypothesis check from the criteria , in particular the Student and Fisher criteria used abroad information and results based on digital banking profitability of innovations and financial to stability impact clearly was given .

Analysis and results.

This paper uses the provincial panel data of the Digital Finance Support Index published by the Digital Finance Research Center of Peking University to assess the development level of digital finance. This data has a certain degree of authority and is used by many scholars in the field to measure the development level of digital finance. The index calculated based on Alipay Ant Financial data includes a financial support index covering 31 provinces in China. Since the provincial and city-level indices cover a period of almost a decade, the index is suitable for horizontal and vertical comparisons. Based on existing studies, the following variables are selected for control: Regarding the financial level of banks, this paper adopts the bank size (Size), profitability ROA and capital structure EDR; At the macro level, the local economic development level GDP, local inflation rate CPI and monetary policy environment M2R are selected [16].

This article uses a fixed effects panel data method through an economiceconometric model, controlling for the individual impact of banks, and analyzing the impact of digital finance on bank credit structure and banks' risk-taking.

First, using model (4.1), the impact of digital finance development on the credit structure of banks—that is, banks' credit volume, credit composition, and customer composition—is analyzed:

Structurei, $t = \alpha_0 + \alpha_1 i dexi$, $t + \alpha$ Controli, $t + \mu i + \gamma i$, t (1.1)

Secondly , the model (4.2) is numerically finance and bank loan mutual impact through banks' risk -taking how impact to show analysis does :

Riski , t = $\beta_0 + \beta_1 i dexi$, t + $\beta_2 Structurei$, t + β_3 (i dexi) Controli , t + μi + γi , t (1.2)

This in formulas :

- α and β – the intercept points of the equation ,
- i and t suitable accordingly *i-bank* and *t- year* indicators indicates ,
- *µi* every individual fixed for one bank effect ,

• γi , t – random error member means .

Precise variable indicators , including "Structure" and "Control " expressed clear variables definition shown in Figure 1 below :



O'zgaruvchan	Oʻzgaruvchi nomi	ıvchi nomi		O'zgaruvchi tavsifi
Tushuntirilgan oʻzgaruvchi	Kredit tuzilmasi	Kredit shkalasi	Qarz	Jami kreditlarning tabiiy jurnali
		Kredit tuzilishi	CreL	Kredit summasi/jami kredit *100
		Mijozlarning tuzilishi	PerL	Shaxsiy kredit summasi/Jami kredit summasi *100
	Bank xavfi	Ishlamaydigan kreditlar nisbati	Xavf	Ishlamaydigan kreditlar nisbati = (subprime kreditlar + shubhali kreditlar + zarar kreditlar)/barcha kreditlar * 100
Asosiy tushuntirish oʻzgaruvchisi	Raqamli moliyaning rivojlanish darajasi	Umumiy indeks	indeks	Pekin universitetining raqamli moliyaviy qo'shilish indeksining viloyat ma'lumotlari
Boshqarish oʻzgaruvchisi	Bankning moliyaviy _{darajasi}	Bank hajmi	Hajmi	Jami aktiv hajmining natural logarifmi
		rentabellik	ROA	Jami aktivlarning rentabelligi
		Kapital tarkibi	EDR	Oʻz kapitali/jami majburiyatlar
	Makro darajasi	Mahalliy iqtisodiy rivojlanish darajasi	YalM	Mahalliy nominal YalM o'sishi *100
		Mahalliy inflyatsiya darajasi	CPI	Joriy iste'mol narxlari indeksi
		Pul-kredit siyosati muhiti	M2R	Joriy davr uchun keng pul massasining o'sish sur'ati

Figure 1. Variable indicators definition [16]

In order to study the impact of digital finance on the credit structure of commercial banks, this section conducts a normative regression analysis on the model, and the specific results are shown in Figure 2. Among them, (A) results show that the coefficient of the development level of digital finance is significantly positive, which means that the development of digital finance helps to expand the credit volume of commercial banks; (B) The regression coefficient is positive and the result is significant, which indicates that the development of digital finance has a positive impact on the credit loan ratio of commercial banks; (C) The regression results show that the development of digital finance has helped to increase the ratio of personal loans to total loans. The above regression results prove that the

development of digital finance helps to increase the bank credit volume and affects the structure of bank loans, which confirms the hypothesis H1.

	(A)	(B)	(C)
	KREZ	CREL	PERL
Ideks	0,001***	0,017***	0,0942***
	(9,198)	(4,852)	(22.534)
Hajmi	0,859***	4,644***	-7.060***
	(35.468)	(6.410)	-(7.932)
ROA	0,093***	-3.427***	4,669***
	(3,556)	-(4.055)	(4.201)
EDR	0,042***	0,238*	-0,696***
	(9,973)	(1,903)	-(6.493)
YalM	-0,002	0,251***	0,013
	-(1.336)	(3,847)	(0,156)
CPI	0,022***	1,020***	1,694***
	(6.010)	(7,787)	(10.661)
M2r	0,008***	0,184***	-0,323***
	(6,060)	(3,960)	-(5.709)
С	0,034	-233.052***	29.066
	(0,046)	-(9.926)	(1,057)
Adi-R2	0,9988	0,9552	0,9352

Figure 2. Digital finance bank loan to the structure return [16]

This section studies the impact of digital finance on banks' risk-taking. Because it is considered that there may be a lag effect on commercial banks' risk-taking in the previous period and this may affect their risk-taking in the current period, the risk-taking element Lrisk is added to the regression, and a normative regression analysis is conducted on the digital finance indicator and the non-performing loan ratio of commercial banks, and the results are presented in the regression (A) in Figure 3 instead of the conclusion. From this, it can be concluded that the coefficient of the development level of digital finance is negative and significant at the 1% level, which indicates that the development of digital finance can reduce the information asymmetry between banks and lenders, improve the risk management ability of banks, and reduce the risk-taking of banks.

This section further explores the joint impact of digital finance and credit structure on bank risk. The results from (B) to (D) in Figure 3 show the joint impact of commercial banks' credit structure and the level of development of digital finance on banks' risk appetite:

- From the result (B), it can be concluded that the coefficient of the general term between loan volume and digital finance is not significant, and it can be assumed that changes in the loan volume of commercial banks will not have a significant impact on their risk appetite as the development of digital finance deepens;

	(A)	(B)	(C)	(D)		
	Xavf					
Risk	0,356***	0,346***	0,349***	0,360***		
	(9,731)	(9,386)	(9,549)	(9,917)		
indeks	-0,002***	-0,004**	-0,002***	0.000		
	-(8.722)	-(2.455)	-(6.527)	-(1.367)		
qarz	57-3	-0,035				
		-(0,674)				
crel			-0,011***			
			-(3.471)			
perl				0,001		
				(0,178)		
qarz * indeks		0,0001				
		(1,551)				
crel*idex			0,0001*			
			(1,682)			
perl*idex		<u>1990</u>		-0,0001***		
				-(2.597)		
roa	-0,575***	-0,581***	-0,642***	-0,532***		
	-(6.596)	-(6.488)	-(7.399)	-(6.116)		
muhanti	0,078***	0,074***	0,072***	0,084***		
	(5,927)	(5,545)	(5,443)	(6,389)		
GDP	-0,020***	-0,022***	-0,020***	-0,019***		
	-(4.211)	-(4.362)	-(4.173)	-(4.079)		
cpi	-0,076***	-0,071***	-0,062***	-0,072***		
	-(5.478)	-(4.965)	-(4.326)	-(5.121)		
m2r	-0,017***	-0,019***	-0,016***	-0,016***		
	-(5.031)	-(5.279)	-(4.723)	-(4.562)		
с	9.428***	9,904***	8.173	8.690		
	(6,574)	(5,084)	(5,615)	(6,061)		
adj-R2	0,8084	0,8081	0,8117	0,8126		

Figure 3. Digital finance and credit structure : risks acceptance to do impact [16]

- (C) In the regression, it can be concluded that as digital finance becomes more developed, the increase in the share of credit loans in total loans increases the risk-taking of banks. This indicates that with the development of digital technology,

information asymmetry has decreased and more credit loans have been issued, but their risk-taking has also become higher than before.

- (D) The regression results show that as the development of digital finance deepens, the increase in the proportion of personal loans leads to a decrease in bank risk, which indicates that the development of digital finance will stimulate the increase of personal loans in the structure of credit customers, thereby reducing the level of risk.

Although the research in this article has confirmed the impact of digital finance on banks' credit structure and risk acceptance to a certain extent, it can be well understood that the precise and detailed implementation of the research is still insufficient. The selection of credit structure indicators is not fully covered, the measurement of bank risk acceptance is also one-sided, and the development level of digital finance is not sufficiently revealed. In this case, only the panel data of provinces are selected for measurement, and the development level of digital finance of each bank is not clearly shown.

Thus, it would be appropriate for future researchers to conduct more in-depth studies on the impact of digital finance, credit structure, and bank risk acceptance, and to explore all aspects of bank credit structure more broadly.

The main directions of digitalization of the banking and financial sector in Uzbekistan are:

1. **Mobile and internet banking:** Customers use services through mobile apps or web platforms to manage their accounts, make payments, and transfer funds, without having to visit a bank.

2. **Electronic payments:** Residents can make online payments for various services through electronic payment systems such as Click, Payme, and Apelsin.

3. **Fintech:** New services based on financial technology, such as online lending, investment platforms, and personal finance management tools.

4. **Crowdfunding and P2P lending:** Systems for pooling financial resources and peer-to-peer lending are implemented online.

5. **Cryptocurrency and blockchain:** Decentralized financial systems allow for fast, secure, and transparent transactions.

6. Artificial Intelligence and Big Data: Analyzing customers' financial data creates the possibility of personalized financial advice and risk assessment. Of course, these areas provide a number of advantages, which are as follows:

• 24/7 customer service availability;

• Reduce costs and automate operations;

• Financial inclusion - access to financial services for different segments of the population;

• It serves the development of the digital economy;

• Ability to make effective decisions through accurate analysis.

The practice of using digital technologies in Uzbekistan shows that the digital banking and financial sector in the republic has been developing rapidly in recent years. In particular:

• Digital banks such as "Uzum Bank", "TBC Bank", and "Anorbank" have emerged.

• Fintech companies such as Click, Payme, and Apelsin provide payments, loans, and other financial services.

• MyID, QR code payments, and mobile payment platforms are being widely implemented.

In recent years, banks have actively begun to transition to digital transformation. In particular, large commercial banks such as "Ipotekabank", "Asakabank", "Uzmilliybank", "Xalq banki" have introduced digital platforms, mobile applications and online services. At the same time, ecosystem financial services are developing in cooperation with fintech companies such as Uzum Bank, Click, Payme.

At the same time, the Central Bank of the Republic of Uzbekistan and the Ministry of Finance are improving the mechanisms for creating, licensing and controlling digital payment infrastructure. The Central Bank is introducing solutions such as digitization of payment infrastructure, electronic identification (MyID), and payments via QR code. These changes create convenience for customers and expand the scope of banking services.

Also, the researchers' micro-level study of digital finance development indicators, taking into account the implementation of financial services and transactions by each financial institution based on digital technologies, and the digitization of traditional banking and financial services, which allows customers to use financial services quickly, conveniently and efficiently, will stimulate further development of relevant research in this area. Because we should also take into account that in today's global economy, digital technologies are transforming not only the banking and financial sector, but also the entire socio-economic system.

Conclusion.

The article empirically studies the mechanisms and factors of the impact of digital transformation of banks on the volume and structure of credit supply using panel data of several commercial banks based on foreign studies and the nonlinear DID method. The empirical results show that digital transformation implemented through guarantees does not have a significant impact on the volume of credit of commercial banks, but can optimize their credit structure and increase credit

support for small and medium-sized enterprises. These conclusions are confirmed by a number of robustness tests.

The impact mechanism of digital transformation accelerates the digitization of management and business processes of commercial banks, reduces management costs, improves the ability to cover risks, and helps the bank's credit structure focus on small and medium-sized enterprises and the real economy. In addition, the impact of digital transformation is not the same for all banks. Since the management methods of different commercial banks are different, their data sorting capabilities differ significantly, and also have different impacts on the credit structure. Compared with domestic banks, digital transformation based on incentive guarantees has a significant impact on the credit structure of foreign commercial banks operating in many regions.

Thus, as mentioned above, it is necessary to widely introduce the most effective digital technologies, which are widely used in international banking practice, into the practice of banks of our republic, to ensure information and cybersecurity in payment systems and information systems of commercial banks, and to improve the practice of using digital technologies in the banking system. As we have seen above, based on foreign research and experience and as a result of significant work carried out in recent years on the digital transformation of the national banking system of Uzbekistan, digital information technologies have become one of the important conditions for achieving progress in all areas. In recent years, Fin-tech companies have become active in the financial market and have become strong competitors of commercial banks in some financial practices. In such conditions, it is necessary to further accelerate digital transformation work in commercial banks. From this we can conclude that the digital transformation of commercial banks is a strategic process aimed at the future, the effective implementation of which will serve the sustainable development of the economy. By introducing digital solutions, banks not only strengthen their position in the market, but also create real value for customers. In this process, government policy, cooperation with fintechs, and training of personnel are important factors. Incentive policies, infrastructure development, and increasing the digital literacy of the population serve as the basis for the sustainable growth of digital finance.

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