

The dynamics of digital banking services implementation in Ukraine: Quantitative analysis based on open data from the National Bank of Ukraine and banking reports (2019-2024)

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Abstract. The aim of this study was to identify trends in the use of digital banking services in Ukraine based on a quantitative analysis of open statistical data for the period 2019-2024. The research methodology was based on the collection and processing of empirical indicators, in particular: the volume of cashless transactions, the share of transactions by amount and number, the average cheque, the structure of transactions (transfers, purchases, withdrawals), the number of mobile banking users, the digital literacy of the population, and the volume of banks' investments in information technology. Data on cybersecurity spending and the dynamics of digital service channels were studied separately. As a result, it was found that the share of cashless transactions increased from 50% in 2019 to 64.5% in 2024 in terms of amount, and from 80% to 94.6% in terms of number. The number of mobile users increased more than fourfold: from 5.9 million to over 25 million people. It was also noted that over 76% of citizens made daily payments via mobile applications, and the share of contactless transactions reached 94.9%. It was determined that banks invested up to 10% of their operating expenses in the development of information technology, and the cybersecurity market reached USD 138 million in 2024, which is 70% more than in 2023. Significant differences in digital transformation were found depending on the form of ownership of the bank. State-owned banks had the highest profitability indicators, while foreign banks had the highest level of trust. The study proved that digitalisation contributed to increased efficiency, reduced costs and supported the financial stability of banks during the period of martial law. The practical significance of the study lies in the possibility of using its results to form effective strategies for the digital transformation of banks and improve state policy in the field of financial inclusion in the context of crisis challenges

Keywords: innovation; mobile applications; transformation; investment; credit

Introduction

The digital transformation of the financial sector has become a key factor in ensuring the competitiveness, accessibility, and continuity of banking services. Ukraine, as a country with an ambitious digital strategy, demonstrates a growing integration of innovative technologies into banking activities. This process gained significant prominence in the context of the COVID-19 pandemic, which stimulated a mass transition of clients to online services, and the full-scale war, which intensified demands for the resilience and adaptability of financial infrastructure. In conditions of limited access to physical branches and increased

population mobility, digital services have become critically important for maintaining financial stability at the household and enterprise level.

In the process of digital transformation of Ukraine's banking system, there arises a need for objective measurement of the pace of digital service implementation and their impact on banking operations. D. Kretov & O. Mindova (2024) analysed the state of digitalisation, characterised key technologies, the dynamics of branch reduction, and outlined the main challenges associated with cyber threats. The authors focused on the qualitative aspects of

Suggested Citation:

Lutsenko, V. (2025). The dynamics of digital banking services implementation in Ukraine: Quantitative analysis based on open data from the National Bank of Ukraine and banking reports (2019-2024). *Innovation and Sustainability*, 5(2), 30-41. doi: 10.31649/vis/2.2025.30.

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transformation and general trends of digital transition. The digital transformation of the banking system has caused significant changes in the methods of service provision, client interaction, and the organisation of internal processes; however, a coherent vision regarding optimal directions for regulatory support of these changes has not yet been formed. S. Reverchuk & O. Tvorydlo (2023) investigated the advantages of digital banking technologies, outlined changes in client behaviour under the influence of the pandemic and the growing role of mobile and internet banking, and analysed the dynamics of banking branch reduction. The work performed a forecast of the number of branches until 2028 and substantiated the expediency of creating a regulatory framework for digital lending.

In the process of transitioning to electronic service formats, it is not sufficiently clear to what extent digital services affect the transformation of banking business models and client interaction strategies. O. Yesina (2023) investigated trends in the development of electronic banking in Ukraine, focusing on the growing popularity of online services, the expansion of mobile application functionality, increased speed and convenience of service, and the importance of consumer digital literacy. The author provided a comprehensive qualitative description of digital changes, described the advantages and challenges for banks in the new digital environment. In the context of the digital transformation of the financial environment, the question of consistency between banks' strategic priorities and the expectations of digital service consumers remains open. A. Orel & V. Diachenko (2024) investigated digital client service channels in the banking sector, focusing on the increasing share of online communications, enhanced client loyalty through personalised services, and the development of mobile applications. The work outlined the advantages of implementing digital technologies to improve client experience and formulated recommendations for further automation of service processes. In the sphere of digital banking models, there arises a need for a deeper understanding of how legal regulation affects the formation of new interaction formats between banks and clients. D. Kretov (2024) focused on the classification of digital banks, identified the key features of neobanks, digital divisions of traditional banks, and fully virtual financial institutions. The author revealed the legal status of such entities and emphasised the necessity of adapting the regulatory framework to the conditions of the digital environment. The work provided proposals for legislative changes and presented general characteristics of the business models of digital banks.

Despite the active development of digital services in the banking system, the connection between the level of digitalisation and the financial performance of banks in various organisational and legal forms remains insufficiently studied. V. Erastov & I. Lyzhechko (2024) examined the specifics of digital innovations in banks with foreign capital, identified their leading position in implementing remote services, expanding mobile application functionality, and digital lending. The work analysed the main

directions of business process modernisation using leading banks as an example, focusing on changing client priorities and the impact of digitalisation on the structure of banking expenses. In the process of digital transformation of the banking system, the question of the correspondence between technological changes and the real needs of clients and the specifics of the Ukrainian financial environment remains relevant. T. Butenko (2025) investigated structural changes in banking service delivery channels, outlined the key stages of digitalisation of Ukrainian banks, and analysed the impact of martial law on the pace of digital solution implementation. The author provided a description of the main advantages of remote service, including mobility, security, and accessibility of financial instruments, and also drew attention to the increased trust in digital products during the war period.

In the process of implementing digital financial services, the question of the impact of digital channels on the effectiveness of banking services, considering consumer behavioural characteristics, remains insufficiently explored. O. Martseniuk *et al.* (2024) examined the main directions of banking digitalisation, focusing on the importance of internet and mobile banking, the growing demand for remote services, and the transformation of internal business processes under the influence of digital technologies. The work analysed technological trends, proposed ways to increase banks' competitiveness, and emphasised the need to adapt the regulatory environment. However, existing studies lack a complete quantitative assessment of the digital transformation of banking services in Ukraine: indicators of online transactions, information technology (IT) costs, mobile banking usage are not presented, and no comparison of banks by type of ownership has been made. The aim of this study was to analyse the evolution of digital banking service usage in Ukraine based on a quantitative study of statistical indicators for 2019-2024.

Materials and Methods

The research was empirical in nature and covered the period from 2019 to March 2025. To analyse the dynamics of digital transformations in the banking sector, statistical indicators on the volume of cashless operations and online transactions were collected (In Ukraine, eight out of ten..., 2019; Cashless payments in Ukraine..., 2025). The shares of cashless operations by number and amount, the average purchase cheque, and the number of transactions across key categories (transfers, goods payments, cash withdrawals) were considered. Changes in the intensity of digital channel usage depending on macroeconomic factors and the impact of external socio-economic events were taken into account. Indicators for 2019-2024 allowed for outlining the general structure of the population's payment behaviour.

Key players in the mobile banking and digital services market were identified based on materials from The best banks in Ukraine in 2024 according to Delo.ua (n.d.), including PrivatBank (n.d.), Monobank (n.d.), PUMB (n.d.),

and Oschadbank (n.d.). Within this stage, an analysis of mobile application functionality, the number of active users, and the market share of digital products among banks was carried out to identify the impact of convenience, innovativeness, and technical accessibility of services on client engagement and the competitiveness of banking institutions. Changes in the structure of digital service channels were studied based on the source More than 70% of all banking transactions are carried out by Oschad customers in a mobile application (2024). The analysis covered the correlation between branches, contact centres, internet and mobile banking, as well as the proportion of clients who fully transitioned to remote service, to ascertain transformational shifts in service and determine trends towards a fully digital banking environment.

A separate block comprised an analysis of differences in the activities of state-owned, private, and foreign-capital banks. For this, profitability and efficiency indicators in 2024 were used (Denisyuk, 2024; Kalashnyk, 2025; The banking system of Ukraine..., 2025). To assess the level of perceived reliability of banking institutions with foreign participation, the most recognisable and representative market players were selected – Citi (n.d.), OTP Bank (n.d.), Credit Agricole (n.d.), and UKRSIBBANK (n.d.). They were chosen because they are characterised by stability, a developed digital infrastructure, and an active presence in the Ukrainian market. The analysis was conducted based on open client reviews and the results of reputation audits. To compare Ukraine's digital level with Central and Eastern European countries (Poland, Czech Republic, Slovakia, Hungary), data from A. Lozmann *et al.* (2023) were used, which allowed for assessing the relative maturity of the Ukrainian banking digital environment, the level of online service implementation, mobile banking coverage, and the degree of integration of innovative financial technologies in the regional context. The study also took into account demographic aspects – the structure of users by age, income, and level of digital literacy – to identify social factors determining the pace and depth of adoption of digital banking services (Derkach, 2024).

Within the scope of the study, socio-demographic aspects, particularly the level of digital literacy of the population, were also taken into account. The number of citizens who successfully completed digital literacy educational courses through the Diia.Osvita platform with the support of the United Nations Development Programme (Over 25,000 people..., 2024) was analysed. This indicator was included in the overall assessment of changes in the population's preparedness to use online banking and digital financial services, allowing for a more precise outline of the social context of banking digitalisation. The final stage of the study covered the identification of barriers in the digitalisation process, including: regulatory restrictions, a shortage of IT specialists, low financial and digital literacy among a part of the population, and cyber threat risks. This was done to comprehensively assess the factors influencing the accessibility and level of adoption

of digital banking services by various socio-demographic groups of the population in the context of financial system transformation.

Results and Discussion

The dynamics of digital service implementation in Ukraine's banking sector (2019-2024)

In the context of the digital transformation of Ukraine's financial sector, the dynamics of cashless payments and the development of mobile banking deserve attention. Throughout 2019-2024, the role of digital financial instruments significantly increased for both individuals and businesses. Improvements in payment infrastructure, increased financial literacy among the population, and the widespread adoption of smartphones and mobile internet contributed to the active implementation of cashless technologies in everyday transactions. In 2019, the share of cashless payment card operations in the total volume was approximately 50% by transaction value and 80% by quantity. Such a level of digitalisation indicated the initial stage of forming a cashless environment (In Ukraine, eight out of ten..., 2019). Subsequently, growth rates remained consistently high: over nine months of 2024, the share of cashless transactions reached 64.8% by value and 94.5% by quantity. By the end of 2024, the corresponding figures were 64.5% and 94.6%. In total, 8,654.4 million payment card operations were carried out in 2024, amounting to UAH 6,577.4 billion, of which 8,184.8 million operations totalling UAH 4,243.5 billion were cashless payments (Cashless payments in Ukraine..., 2025).

In the structure of cashless transactions, payment for goods and services in retail networks dominated – 73.4% of the total number and 46.8% of the total value. In 2024, over 6 billion such operations were conducted, totalling almost UAH 2 trillion. The average transaction value was approximately UAH 330. Card-to-card transfers accounted for 8.2% of cashless operations by quantity and 31.1% by value (over UAH 1.3 trillion), with an average transfer amount of approximately UAH 1,958 (Cashless payments in 2024..., 2025). Online payment for goods and services accounted for 13.6% by quantity and 14.7% by value (approximately UAH 622 billion), with the average transaction amount reaching UAH 561. At the same time, over 90% of retail transactions were performed contactless – using NFC technology (How many payment transactions..., 2024).

Parallel to the increase in the share of cashless operations, there was an intensive growth in the number of mobile banking users, indicating the gradual formation of sustained demand for digital financial services among the population. In 2019, the number of mobile banking application users was 5.9 million people. In 2020, this figure increased to 7.1 million, which is 17% more compared to the previous year. Over the following years, growth rates remained high: in 2021 – 10 million, in 2022 the number of active users reached 13.5 million, in 2023 – 18.3 million. According to preliminary estimates, in 2024, the number of active mobile banking users exceeded 25 million people,

indicating a large-scale digitalisation of banking services in Ukraine (Cashless payments in Ukraine..., 2025).

Figure 1 reflects the dynamics of mobile banking users from 2019-2024.

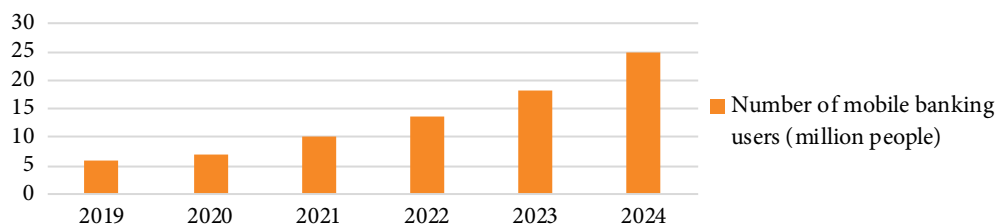


Figure 1. Dynamics of the number of mobile banking users in 2019-2024

Source: compiled by the author based on Cashless payments in Ukraine: 95% of transactions are cashless (2025)

Among the market leaders in mobile banking services in 2024, Monobank (n.d.), PUMB (n.d.), PrivatBank (n.d.), and Oschadbank (n.d.) can be singled out. Monobank has established itself as an innovative mobile bank with a wide range of digital services and received industry awards for the innovativeness of its mobile application. PrivatBank, as the largest bank by assets, had the broadest client reach, while Oschadbank actively modernised its digital infrastructure. Top leaders also include Raiffeisen Bank, Ukreximbank, and Ukrsibbank, which have a high level of digital presence and developed mobile services (The best banks in..., n.d.). Thus, in 2019-2024, Ukraine experienced a qualitative shift towards forming a cashless environment and expanding access to mobile financial technologies. These processes ensured increased efficiency of the payment system, reduced cash circulation costs, and increased transparency of financial operations. Throughout 2019-2024, the digitalisation of the banking sector was accompanied by significant transformations in the structure of client service, where mobile and remote channels gained priority. According to estimates by the National Bank of Ukraine, as of early 2024, over 79.5% of individuals (approximately 62.3 million clients) conducted banking services remotely, without visiting physical branches. In particular, Oschadbank's mobile application has over 4.6 million active users, and over 70% of all this bank's transactions are conducted through it. This trend confirms the gradual shift of banks away from traditional service channels in favour of digital platforms (More than 70%..., 2024).

Concurrently, the structure of banks' capital expenditures is also shifting. The growth in the volume of operations through online channels necessitated the systematic renewal of IT infrastructure, process automation, and expansion of mobile application functionality. According to leading consulting companies, Ukrainian banks invested an average of 7-10% of their operating expenses in IT development during 2020-2023. Funds were primarily directed towards the development of mobile banking, digital identification, Customer Relationship Management (CRM) systems, Big Data analytics, as well as platforms for remote lending and deposit operations. A separate vector of IT investments is cybersecurity. In 2024, the cybersecurity market in Ukraine reached approximately 138 million USD,

which is 13.1% more compared to 2023 and almost 50% more than in 2021. A significant portion of this volume fell precisely on the financial sector, particularly banking institutions. The increase in cybersecurity spending is due to a significant rise in risks: the number of registered cyber incidents increased from 2,544 in 2023 to 4,315 in 2024 – by 70% (More than 70%..., 2024). In response to the growing threat, the National Bank of Ukraine designated cybersecurity as one of its key priorities in regulatory policy. Specifically, initiatives to increase banks' cyber resilience, modernise information protection tools, implement international security standards, and use cloud services are actively supported. The cost of cloud solutions in the security sector in 2024 was about 1.7 million USD, which is 41.7% more than the previous year. Additionally, it is worth noting that the total volume of international technical assistance to Ukraine in the field of cybersecurity from 2016-2024 reached approximately 200 million USD, and a portion of these resources was directed precisely to modernising the cyber protection of financial institutions (Over the past 8 years..., 2025). Despite the lack of detailed information in banks' open financial statements regarding the volume of cybersecurity expenditures, indirect estimates indicate that the share of such expenditures rapidly increased in 2022-2024, primarily due to the need to protect critical infrastructure in conditions of martial law.

The work of P.T.T. Tran *et al.* (2023) and this study examined the impact of digital banking services on the overall effectiveness of the banking sector; however, the analytical approaches were fundamentally different. P.T.T. Tran *et al.* used panel data from 11 countries, applying econometric models (pooled ordinary least squares (POOL), fixed effects model (FEM), random effects model (REM), feasible generalised least squares (FGLS)) to identify the dependence between digital transactions and banking productivity, particularly deposit and loan volumes. In contrast, this study focused on the specifics of digital transformation in Ukraine in 2019-2024, with a detailed analysis of the growth of mobile banking, the share of cashless operations, and changes in the structure of IT investments. The study by S. Lee *et al.* (2021) aligned with this one in highlighting the key advantages of digitalisation, such as expanding financial inclusion and technological innovation. At the same

time, S. Lee *et al.*'s priority topics were artificial intelligence, blockchain, and cloud solutions being implemented in stable Asian economies, whereas this study revealed the mechanisms of Ukrainian banks' adaptation to a wartime economy, especially in the context of cybersecurity, rapid digital restructuring of services, and changing client behaviour.

The publication by A.G. Manta *et al.* (2024) and this study converged in conclusions regarding the role of digital technologies as a driver of change in the banking system. However, A.G. Manta *et al.* meticulously analysed the digital resilience of European Union (EU) banks, cyber threat risks, and the implementation of ESG approaches to banking management. In comparison, this study focused on operational digital transformations under the pressure of war, with particular attention to the growing share of online services and cashless payments. In the work of S.B. Rakocevic *et al.* (2025), the main emphasis was on the interrelationship between digital banking services, risks, client expectations, and satisfaction levels in the Western Balkan countries. This approach differed significantly from the focus of this study, which concentrated on digital infrastructure reforms in the Ukrainian banking sector under crisis conditions. Despite differences in regional scope and analytical approaches, both studies demonstrated the importance of digitalisation as a factor in strengthening client trust and increasing operational efficiency.

Thus, in 2019-2024, Ukraine observed an intensive growth in the digitalisation of banking services, manifested in an increase in the share of cashless operations, active use of mobile banking, and modernisation of IT infrastructure. These processes significantly contributed to increasing the efficiency of the banking system and reducing cash handling costs. The growth in the number of digital service users, large-scale investments in cybersecurity, and the development of remote services demonstrated a high level of banks' adaptation to wartime challenges.

Comparative characteristics of digital transformation of different types of banks

Between 2019 and 2024, the banking system of Ukraine included three main groups of institutions: state-owned banks, private banks with Ukrainian capital, and banks with foreign participation. Each of these categories was characterised by distinct management approaches, levels of financial efficiency, asset and deposit structures, scales of physical presence, and client trust. Throughout the analysed period, state-owned banks maintained leading positions in key macroeconomic indicators. In 2024, they controlled 53.3% of the banking system's net assets and 63.4% of individual deposits. The share of foreign banks in assets was approximately 33%, while their share in individual deposits decreased to 16.4% – the lowest value since 2020 (National Bank of Ukraine, 2024). Private banks with Ukrainian capital held 13-14% of assets and 19.1% of deposits, demonstrating a tendency towards gradual growth, especially in 2023, when their share in individual deposits increased by 1.5 percentage points (Finance Club, 2024).

The level of profitability also showed significant differences. In 2024, Ukrainian banks recorded a record net profit of over 103 billion UAH, which was 20% higher than the 2023 figure. State-owned banks had the highest profitability indicators: Return on Assets (ROA) – 3.5-4.0%, Return on Equity (ROE) – 25-30%, which was explained by a large share of investments in domestic government bonds (DGB) and the scale of operations. Private banks demonstrated ROA at the level of 2.5-3.5% and ROE – 18-25%, maintaining stable efficiency (Kalashnyk, 2025). Foreign banks, despite lower profitability (ROA – 1.5-3.0%, ROE – 15-22%), remained a stable segment with a high level of risk management (Denisyuk, 2024). The discrepancies in the financial efficiency of different groups of banking institutions are illustrated in Table 1, which presents the average values of ROA and ROE indicators for 2024.

Table 1. Profitability of Ukrainian banks in 2024 by type of institution

Bank type	ROA (%)	ROE (%)	Comments
State-owned banks	3.5-4.0	25-30	Dominant in the banking system's profits. PrivatBank recorded UAH 40.1 billion in profit, Oschadbank UAH 14.8 billion, and Ukreximbank UAH 5.6 billion. High profitability is attributed to a significant share of their loan portfolios and investments in domestic government bonds
Private banks	2.5-3.5	18-25	Raiffeisen Bank (UAH 4.3 billion profit), OTP Bank (UAH 4.1 billion), Crédit Agricole (UAH 4.1 billion), and PUMB (UAH 3.9 billion) demonstrate stable profitability
Foreign banks	1.5-3.0	15-22	Generally, hold a smaller share of overall profit, though some banks, like Citibank (UAH 2.19 billion), show strong performance

Source: compiled by the author based on I. Denisyuk (2024), P. Kalashnyk (2025), The banking system of Ukraine is growing and increasing its profitability (2025)

The physical infrastructure of banks has gradually contracted. While over 20,000 bank branches operated in Ukraine in 2012, their number had shrunk to approximately 5,000 by early 2025. In 2024, about 200 branches were closed, and in 2025, another 45. Among state-owned banks, PrivatBank had 1,105 branches, and Oschadbank – 1,152. Foreign banks, notably Raiffeisen Bank and Ukrsibbank, had 325 and 218 branches respectively. Private banks,

such as PUMB, maintained smaller networks – 223 branches and fewer (Bilous, 2025). The level of customer trust in 2024 varied depending on the type of bank. Foreign banks, such as Citi (n.d.), OTP Bank (n.d.), Credit Agricole (n.d.), and UKRSIBBANK (n.d.), demonstrated the highest assessment of financial reliability, often receiving 4-4.5 stars on a five-point scale (Shpytko & Drobiazko, 2025). State-owned banks (PrivatBank, Oschadbank) enjoyed high trust due to

state guarantees and a broad customer base, although they ranked lower than foreign institutions (Zharikova & Verbovenko, 2022). Private Ukrainian banks showed a gradual increase in trust, a result of improved service quality, digital transformation, and financial stability (Rating of reliable banks..., n.d.). In 2019-2024, state-owned banks played a system-forming role, facilitating the majority of socio-economic transactions; private banks acted as a source of innovation and competition; and foreign banks served as a stabilising factor and conduits for international standards. Under martial law, all three groups demonstrated adaptability and made a significant contribution to preserving the stability of Ukraine's financial system.

In 2025, the level of digitalisation in Ukraine's banking sector reached new heights, allowing for comparison with leading countries in Central and Eastern Europe (CEE), specifically Poland, the Czech Republic, Slovakia, and Hungary. One of the key indicators of this process is the spread of mobile banking. Over 76% of Ukrainians make daily payments via mobile applications, and 95% prefer digital payment methods (Financial monitoring 2025..., 2025). Compared to the Visegrad Four countries (Poland, Czech Republic, Hungary, Slovakia), where the proportion of mobile banking users ranges between 60-75%, Ukraine demonstrates competitive results, despite limited resources and challenges associated with the war (Lozmann *et al.*, 2023). For example, in the Czech Republic, about 78% of the population uses online banking, but the level of trust in open banking there is not yet high – only 30% of consumers are interested in using their data. In Slovakia, a national standard, the Slovakia Banking Application Programming Interface (API) (Slovak Banking API..., n.d.), has been in effect since 2018, but general public awareness of the benefits of open banking remains insufficient. In Hungary, the development of relevant services is stimulated by adherence to Payment Services Directive 2 (PSD2) norms, but banks themselves show restraint, and the level of online banking remains lower. In Poland, despite a slightly lower level of digitalisation, 39% of consumers are actively interested in the development of open banking, and regulators support innovations through a national API standard and innovation hubs (Open banking in Europe..., 2025).

In this context, Ukraine only recently began actively implementing open banking (Concept of open banking..., 2023). In August 2024, the first national platform based on Tietoevry Banking was launched. The National Bank of Ukraine set clear implementation requirements, and banks are actively working to ensure compliance. As of 2025, most institutions were at the stage of implementing basic API services – such as Account Information Services (AIS) (account access) and Payment Initiation Services (PIS) (payment initiation), and the expansion of functionality was just beginning (Grinšpane, 2025). Financial support for digitalisation also varies. In the Visegrad Four countries, the share of banks' investments in digital transformation is about 8-12% of the banking sector's net income (Buglea *et al.*, 2025). For comparison, in Ukraine, this

indicator remains lower – about 4-6%, although the very fact of stable funding in wartime conditions already indicates the priority of digital strategies. Additionally, it should be noted that CEE countries actively utilise EU programmes, particularly “The Digital Europe Programme” (n.d.), whose total budget exceeds EUR 7.5 billion. In these countries, European Digital Innovation Hubs (EDIH) have been established, which help businesses and banks test new digital solutions. Ukraine joined the “Digital Europe” programme in 2022, gaining access to funding of about EUR 6 billion by 2027. A network of EDIHs has been created in Ukraine, supporting the digital transformation of both banks and the public sector. Furthermore, a national Digital Development Strategy until 2030 is in effect, covering aspects of artificial intelligence development, cloud technologies, cybersecurity, and digital skills (Resolution of the Cabinet of Ministers of Ukraine No. 1351-r, 2024). Within the framework of international programmes, calls for proposals with grant funding of up to EUR 10 million have been announced to support innovation in the financial sector (Open competitions of..., 2025).

While the research by M. Sultanova *et al.* (2024) and this study both addressed the digitalisation of the banking sector, each highlighted different aspects: the former focused on financial inclusion for rural populations and vulnerable groups, whereas this work prioritised nationwide technological changes – specifically, the growth of mobile banking, the transition to cashless operations, and the development of IT infrastructure. Thus, both approaches underscored the importance of mobile banking, but from social and technological perspectives, respectively. Meanwhile, the study by E.B. Gyau *et al.* (2024), like this research, demonstrated the positive impact of digital banking services on the efficiency and resilience of the financial sector. However, the difference lies in the regional focus and context: E.B. Gyau *et al.* (2024) investigated African countries with an emphasis on rural inclusion, while this study analyses Ukrainian banks under wartime conditions, particularly from the perspective of cybersecurity, mobile banking, and cashless transactions.

The work of M. Schreieck *et al.* (2024) is similar to this study in its conclusions regarding the significance of digitalisation for banking efficiency. However, while M. Schreieck *et al.* examined the strategic re-thinking of digital platforms in stable conditions in Germany, this study demonstrates how Ukrainian banks were forced to adapt to crisis conditions, transforming their services during wartime, including strengthening cybersecurity. In the work of G.B. Ferilli *et al.* (2024), digital technologies are viewed as a catalyst for innovation and a means of strengthening trust through corporate social responsibility. In contrast, in this study, digital services are primarily a tool for anti-crisis adaptation, aimed at ensuring the stable functioning of banks and access to services in extreme conditions. The approaches of C. Xie & S. Hu (2024) and this study are united by their attention to the technological transformation of banks but differ in context. The Chinese authors analysed the role

of the state in supporting digital transformations, while the Ukrainian study focused on banks' independent response to the challenges of war, especially in the areas of mobile banking, infrastructure, and cybersecurity. The work of M. Amiri *et al.* (2023) also touches upon the topic of digital transformation in banks, emphasising obstacles to its implementation in developing countries from the perspective of client perception. This study, however, focuses on a quantitative analysis of banking digitalisation in Ukraine, revealing trends in IT investments, cashless payments, and the role of digital services in increasing the resilience of the banking system.

The study confirmed the key role of digital technologies in the transformation of Ukraine's banking sector under wartime conditions. Mobile banking, the growth of cashless operations, and the development of IT infrastructure became the main tools for adapting to crisis conditions. Digitalisation contributed to increased accessibility of financial services, growing client trust, and strengthening the financial stability of banks. The obtained results demonstrate the effectiveness of the implemented solutions and define directions for further changes in the industry.

Socio-demographic and regional aspects of digital banking service usage

Between 2019 and 2024, Ukraine's banking sector underwent significant transformations in the structure of its banking service users, driven by widespread digitalisation of the financial sector. These changes were caused by both global trends in financial technology development and internal challenges, including the COVID-19 pandemic, military actions, and the need to ensure remote access to services. The most indicative change was the sharp increase in the number of mobile banking users: while in 2019, about 40% of the adult population used digital channels, by 2024 this figure exceeded 60%. The user structure showed a noticeable expansion of coverage not only among young people but also in age categories over 40. Ukrainians aged 18-39 remained the most active, with over 70% regularly using mobile applications. However, the share of age groups 40-60, as well as individuals over 60, also significantly increased: as early as 2020, 37% of Ukrainians aged 61-65 began regularly making online payments (Derkach, 2024).

The digital transformation of banking services was also supported by an increase in the population's digital literacy. According to the Ministry of Digital Transformation, in 2023, 60% of adult Ukrainians already possessed basic digital skills – 12.6% more than in 2019. The proportion of individuals with a high level of digital competence reached 38%, and the number of people who had no such skills at all almost halved – to 7.2%. Young people traditionally demonstrate the highest indicators of digital preparedness: among teenagers aged 10-17, this level was 85.9%. However, active work was also carried out with other age groups – educational campaigns, the national “Digital Test”, digital education hubs, and the Diia.Education (n.d.) platform contributed to the gradual increase in digital awareness

among individuals up to 70 years old, where 93% already had some level of digital skills (Derkach, 2024).

The level of access to digital services was largely determined by technical infrastructure. In 2025, mobile internet coverage reached 98% of the country's territory (excluding temporarily occupied territories), and in rural areas, this figure approached 91%. According to data, 94.1% of mobile connections in Ukraine are made via broadband (3G, 4G, 5G), ensuring stable access to digital banking services even in small settlements (Petrovskiy, 2025). Between 2019 and 2024, over 6 million Ukrainians underwent digital literacy training through initiatives from the Ministry of Digital Transformation and international partners (6 million Ukrainians..., 2024). In 2023 alone, over 550,000 users were registered on the Diia.Education (n.d.) platform, receiving about 900,000 certificates, and in 2024, over 25,000 people studied in libraries – Digital Education Hubs created with the support of the United Nations Development Programme (UNDP). This created the preconditions for an increase in the number of independent users of banking services who do not contact staff or cashiers (Over 25,000 people..., 2024). The level of user independence is particularly illustrated by cashless transaction statistics. In the first half of 2024, over 94% of transactions using payment cards were cashless, and the share of contactless operations (via cards or smartphones) reached 94.9%. This indicates almost complete user adaptation to digital tools and a rejection of physical interactions with the bank. In 2019, these indicators were significantly lower, demonstrating a rapid increase in independent use of digital services (How many payment transactions..., 2024).

One of the key challenges on the path of digital transformation of Ukraine's banking sector is a complex set of barriers, both internal and external. Banks operate in a high-risk environment where ensuring stability and liquidity is a priority. This forces financial institutions to approach innovations cautiously, as any miscalculations in implementing digital services can have significant financial consequences. Such an approach slows down the pace of digitalisation, especially in regional or small banks with limited capital. A second important barrier is the imperfection of the regulatory and legal environment. Some terms related to digital banking technologies still lack a clear definition in Ukrainian legislation. The absence of legal definitions for concepts such as “electronic banking,” “digital bank,” or “neobanking” creates legal uncertainty, complicating the development and implementation of new services. Regulatory requirements, oriented towards traditional financial models, do not always take into account the peculiarities of modern digital services, which hinders innovative dynamics.

The digital transformation of banks requires significant financial investments. The high cost of new infrastructure, licensed software, cloud technologies, and staff training expenses burden bank budgets. For many market players, this becomes a deterrent, especially in conditions of economic instability and limited funding sources. Human capital

also plays an important role. Despite the high level of IT specialists in Ukraine, the banking sector often experiences a shortage of specialists capable of working at the intersection of finance and technology (FinTech). Additionally, there is a need for continuous professional development of bank employees, as digital solutions change rapidly. Insufficient human resource potential reduces the effectiveness of implementing digital solutions and diminishes banks' competitiveness. Another barrier is the insufficient level of digital literacy among clients, especially in the 60+ age groups. A low level of trust in digital channels, fear of fraud, and lack of experience in using mobile applications or internet banking lead to a low level of engagement of part of the population with new banking services. This requires extensive information and educational campaigns and the development of digital education.

Infrastructural limitations remain a serious obstacle. In 17,310 settlements as of 2020, especially in rural areas, there was unstable access to high-speed internet. This creates digital inequality, which directly affects the level of online banking usage. Security and personal data protection issues also occupy a central place in the digital transformation of banks. The introduction of new services requires the implementation of complex cybersecurity systems, which, in turn, requires additional resources. The increasing number of online fraud cases leads to a decrease in customer trust in digital channels, further complicating the transition to online banking. Socio-economic factors, such as high poverty levels, limited solvency of the population, and unsatisfactory financial inclusion, also reduce demand for digital banking services. For some segments of the population, basic financial needs remain primary, not innovations. Furthermore, political and macroeconomic instability affects the investment climate in the banking sector. Increased business risks reduce the attractiveness of large-scale digital projects and hinder the pace of banking system modernisation (Lekhovych *et al.* 2021). The digitalisation of the banking sector in Ukraine faces multi-level barriers that encompass both technological and socio-economic aspects. Overcoming them requires coordination between state structures, banks, and civil society, with an emphasis on updating the regulatory framework, investing in infrastructure, increasing digital literacy, and building trust in new financial technologies.

In the study by D. Arnaudo *et al.* (2022), the main attention was paid to the strategic aspects of digital transformation of banking business models in Italy, while this work revealed how Ukrainian banks changed their operational activities in response to the challenges of war. The Italian study focused on planning transformations in a stable environment, while Ukrainian realities demanded immediate digital adaptation, particularly through the expansion of mobile banking and strengthening IT protection. The work of A. Faccia *et al.* (2020) considered digitalisation through the prism of cutting-edge technologies – artificial intelligence, blockchain, cloud services – and their impact on analytics, reporting, and fraud control. In

comparison, the study of digitalisation of Ukrainian banking under wartime conditions focused more on ensuring the continuity of banking services, expanding digital customer service channels, and counteracting cyber threats. In the study by F. Bernini *et al.* (2021), digital innovations were considered a factor in forming the long-term reputational value of banks in Italy, which occurred in a stable regulatory environment. This approach differed significantly from the Ukrainian experience, where digitalisation primarily performed an anti-crisis function – ensuring uninterrupted access to financial services and adapting the system to wartime conditions.

In the Spanish market, as shown by the Monitor Deloitte (2020) study, open banking was positioned as a source of strategic advantage in the competitive struggle between banks. In the case of Ukraine, the use of digital technologies was less proactive but extremely practical – they became a tool for supporting the viability of banks in periods of high turbulence. The work of S. Valero *et al.* (2020) focused on analysing the impact of FinTech tools on the profitability and risk profile of Spanish banks. Within the framework of this study, similar processes were considered through the prism of the ability of digital solutions to ensure the flexibility and stability of the Ukrainian banking system, primarily through mobile banking and the growth of the share of cashless transactions. In turn, G. Alborn-Morant *et al.* (2022) focused on behavioural factors that influenced the implementation of online banking in Spanish regions. In contrast, this study emphasised institutional changes – investments in cyber security, the development of digital infrastructure and the strengthening of payment stability in the face of external pressure.

Between 2019 and 2024, Ukraine's banking sector underwent a profound digital transformation, encompassing both technological innovation and changes in user behaviour. The rapid growth in mobile banking penetration, increased digital literacy among the population, and a reduction in the number of physical branches indicate significant progress in the independent use of banking services. The digitalisation process is accompanied by a number of challenges – legal, infrastructural, human resources and social – that require a comprehensive cross-sectoral approach. Overall, digitalisation has become not only a tool for innovation, but also a factor in the stability of the banking system in times of crisis.

Conclusions

In 2019-2025, the Ukrainian banking sector underwent a profound digital transformation, encompassing technology, user behaviour, and management approaches. The share of cashless payment card transactions rose from 50% to 64.5% by value and from 80% to 94.6% by volume. In 2024, over 8.1 billion such transactions were conducted, totalling more than UAH 4.2 trillion. The largest share comprised payments for goods in retail networks – over 6 billion operations amounting to almost UAH 2 trillion, with an average transaction value of approximately UAH 330. Mobile

banking demonstrated rapid growth: from 5.9 million users in 2019 to over 25 million in 2024. Over 76% of Ukrainians use mobile applications daily, and 95% use digital payment methods. This was accompanied by a reduction in physical bank branches: from over 20,000 in 2012 to 5,000 in 2025. Banks, including PrivatBank, Oschadbank, Raiffeisen Bank, and Monobank, actively modernised their digital infrastructure.

The level of digital literacy also increased: 60% of adults possessed basic skills, and among individuals aged 61-65, 37% used online payments. Mobile internet coverage reached 98% of the country's territory, providing the technical basis for digital inclusion. Financially, banks invested up to 10% of operational costs in IT development – mobile applications, digital identification, CRM, and cybersecurity. The cybersecurity market in 2024 grew to USD 138 million. The National Bank of Ukraine recognised

cybersecurity as a priority, supporting the modernisation of security systems, particularly through international aid totalling USD 200 million. The digitalisation of banks in Ukraine became a key factor in financial resilience amidst the war. Prospects for further research in this area include a deeper analysis of the impact of digital banking services on financial inclusion in rural areas and among socially vulnerable population groups.

Acknowledgements

None.

Funding

None.

Conflict of Interest

None.

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Динаміка впровадження цифрових банківських сервісів в Україні: кількісний аналіз за відкритими даними Національного банку України та банківських звітів (2019-2024)

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Анотація. Метою цього дослідження було виявлення тенденцій у використанні послуг цифрового банкінгу в Україні на основі кількісного аналізу відкритих статистичних даних за період 2019-2024 років. Методологія дослідження базувалася на зборі та обробці емпіричних показників, зокрема: обсяг безготівкових операцій, частка операцій за сумою та кількістю, середній чек, структура операцій (перекази, покупки, зняття коштів), кількість користувачів мобільного банкінгу, цифрова грамотність населення та обсяг інвестицій банків в інформаційні технології. Окремо досліджувалися дані щодо витрат на кібербезпеку та динаміка каналів цифрового обслуговування. В результаті було виявлено, що частка безготівкових операцій зросла з 50 % у 2019 році до 64,5 % у 2024 році за сумою та з 80 % до 94,6 % за кількістю. Кількість користувачів мобільних телефонів зросла більш ніж у чотири рази: з 5,9 млн до понад 25 млн осіб. Також було зазначено, що понад 76 % громадян здійснювали щоденні платежі через мобільні додатки, а частка безконтактних транзакцій досягла 94,9 %. Було визначено, що банки інвестували до 10% своїх операційних витрат у розвиток інформаційних технологій, а ринок кібербезпеки досяг 138 млн доларів США у 2024 році, що на 70 % більше, ніж у 2023 році. Було виявлено суттєві відмінності в цифровій трансформації залежно від форми власності банку. Державні банки мали найвищі показники прибутковості, тоді як іноземні банки – найвищий рівень довіри. Дослідження довело, що цифровізація сприяла підвищенню ефективності, зниженню витрат та підтримці фінансової стабільності банків у період воєнного стану. Практичне значення дослідження полягає в можливості використання його результатів для формування ефективних стратегій цифрової трансформації банків та вдосконалення державної політики у сфері фінансової інклюзії в контексті кризових викликів

Ключові слова: інновації; мобільні застосунки; трансформації; інвестиції; кредит