The Main Features of the Use of Digital Technologies in the Financial and Banking Sector

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Abstract

The relevance of the research is dictated by the introduction of innovations in banking operations. Classical financial and credit institutions are transformed into high-tech platforms that can create new profit algorithms, using artificial intelligence, Big Data technology, and a global information base. The purpose of this study is to analyze the demand for digital services in the banking sector by customers and to propose criteria for determining the degree of digitalization of banks. The statistical method and the method of evaluating the activities of organizations taking into account the fact of digitalization have been used. To obtain objective results, various tools have been used to analyze the information space of the Internet: tools for analyzing search queries "Google Trends" and "Yandex Wordstat" to determine the relevance of providing digital services to customers. The technical part of the study, which is directly related to obtaining information from the Internet using both software tools and "manually", was conducted in the period from 2016 to 2021. The results of the study show the connection between the introduction of innovations and the reform of the financial and banking sector. The data was collected from 150 respondents who are experts in the implementation of digital technologies – artificial intelligence, Big Data, blockchain in the field of financial activity. A confirmatory analysis has been conducted to assess the reliability and validity of the digital

technologies used in the financial and banking sector. The study proposes a method for assessing the degree of digitalization of banks: by the level of automation of the main processes; by the number of services provided online; by the speed of operations; by the availability of online services around the clock; by the range of digital technologies used; by the volume of online sales and the volume of transactions conducted using digital technologies.

Keywords

Big Data Technologies, Information, Personal Data, Electronic Form, Confidentiality.

Introduction

At the present stage of civilization development, digital technologies are the main factor of global development. The rapid development of digital technologies has led to the emergence of completely new categories, such as artificial intelligence, smart contracts, big data technology, blockchain, the Internet of things, digital technology platforms, etc., which are used in various spheres of life (Pradhan et al., 2017). According to experts, the introduction and use of digital technologies can increase GDP in China to 23% by 2026, GDP growth in the United States can reach up to 2.3 trillion dollars by 2026. A significant increase in the value generated by digital technologies is also projected in Western Europe (Garg, Gupta, Modgil, 2020). This forecast may be inaccurate due to the economic crisis on the background of the pandemic, however, the use of innovations contributes to the expansion of opportunities, frees up labor resources, robotizes many processes, some processes become fully automated and do not require human intervention. The development of digital technologies in the banking sector is of scientific interest since it is most in demand by the population and enterprises. Citizens and legal entities constantly take out loans, keep money on deposits, draw up insurance contracts and use other services of banks, so innovations used in credit and monetary relations are rapidly developing in a competitive environment, as they are forced to meet the requirements of consumers. In addition, protection against fraud is also associated with digital technologies, which are required to effectively save funds entrusted by citizens and legal entities to banks (Müller, Guido, 2016).

The World Economic Forum noted that classical banking structures, such as universal banks, microfinance institutions, investment banks, and other banking institutions, are being transformed most rapidly due to the need to introduce new digital technologies, update software and information systems. Thus, classical financial and credit institutions are transformed into high-tech platforms that can create new profit algorithms, using

artificial intelligence, Big Data technology, and a global information base. Over time, such high-tech platforms will be able to manage human resources and capital as a single set of capabilities (Bastari et al., 2020).

For example, the use of Big Five technology in the banking sector – an artificial intelligence that creates a psychological personality type based on the collected data – can bring up to 50 million US dollars in net profit per year (Fernández-Villaverde et al., 2020). The use of artificial intelligence in data analysis allows avoiding many risks when concluding transactions, as it takes into account such characteristics of customers as conscientiousness, law-abiding, efficiency, emotional stability, reliability (Kirillova, Blinkov, 2020), while the use of artificial intelligence technologies, neural networks, and other innovations does not exclude the activities of bank employees, but only optimizes them (Jünger, Mietzner, 2019).

Literary Review

Many researchers have devoted their work to the topic of the use of digital technologies in the financial and banking sector, so Garg, Gupta, Modgil (2020) considered the advantages of implementing blockchain technology in banking; Bastari et al. (2020) devoted their research to digitalization in the banking sector, paying attention to the internal motivation of employees when using and implementing new digital technologies in the financial sector;

Aijaz A. Shaikh, Richard Glavee-Geo, Heikki Karjaluoto (2017) explored the link between financial sector reforms and the development of digital technologies that are used in financial and banking services. Banks are increasingly using blockchain technology, big data, artificial intelligence, and other innovations, with a radical change in the entire financial and banking sector as a whole; Wassan Abdullah Alkhowaiter (2020) dedicated his work to the introduction of digital payments and banking services in the Persian Gulf. The analysis of the situation showed that even the introduction of a single digital function in the banking sector can radically change approaches to the entire financial and banking sector: Moritz Jünger, Mark Mietzner (2019), banking is gradually becoming digital, the use of digital innovations in the financial sector leads to the modernization of many operations, such as online lending, payments, insurance leads to remote activities, the use of technology can also lead to the release of labor and many other consequences; Fadoua Khanboubi, Azedine Boulmakoul, Mohamed Tabaa (2019) examined the impact of digital trends using the Internet of things on banking processes, as well as what specific innovations are used in the financial and banking sector and how effective they are, and

many other researchers have considered many issues of digitalization, which affected the financial and banking sector. However, the issues of determining the methodology for the effective use of digital innovations used in financial and banking activities need additional analysis.

Methodology

To achieve the goal of the study, we analyzed the works and reports on the introduction of digital technologies in the financial and banking sector in Western Europe and the United States; conducted a systematic review of scientific articles on digital technologies in the financial sector. We started by reviewing 134 articles and then filtered this list to 36 articles. We considered which digital technologies are most effectively used to optimize the interaction between banks and customers; classified digital platforms used in financial and banking activities.

Various means of analyzing the information space of the Internet were used to obtain objective results:

- The "SiteSputnik" program, designed to automate and organize the professional search, collection, monitoring, and analysis of information posted on the Internet;
- Analysis tool for the search query "Google Trends" and "Yandex Wordstat";
- "Manual" search on "Google" and "Yandex" search engines;

The technical part of the study, which is directly related to obtaining information from the Internet using both software tools and "manually", was conducted in the period from May 31, 2016, to May 28, 2021.

The study of the Internet information space revealed that most banks provide their customers with digital services and the demand of the population for these services is high, the most popular are the following:

- "Online banking" mobile application;
- Payments and transfers online;
- Loan issuance online;
- Payment of fines online.

The statistical method and the method of evaluating the activities of organizations taking into account the fact of digitalization were used. The results of the study show the connection between the introduction of innovations and the reform of the financial and

banking sector. The study aims to measure the perceived benefits of banks from the introduction of digital technologies and identify factors for measuring these benefits. Taking care of security, values, and standards is important for banking operations that are conducted remotely – online. The data was collected from 150 respondents who are experts in the implementation of digital technologies – artificial intelligence, Big Data, blockchain in the field of financial activity. A confirmatory analysis has been conducted to assess the reliability and validity of the digital technologies used in the financial and banking sector. The results confirm that such technologies as a distributed registry, neural networks, open interfaces, and artificial intelligence are at the initial stage of implementation in the activities of banks, while digital services of banks are in demand by the population.

Results

The study of the popularity of digital services among the population allowed making several significant observations.

The first observation concerns the scale of the search for information related to the provision of digital services by banks using the "Google Trends" and "Yandex Wordstat" search resources. The semantic core of the study included four phrases: "Online banking"; "Mobile payments"; "Payment of fines online"; "Credit online".

Using the Google Trends service, it is possible to evaluate the level of interest in a particular search query on a conditional one-hundred-point scale, where one hundred points – the highest degree of popularity of the information sought, and zero points – no search queries in the study period.

The "Online banking" query around the world shows an intermittent growth, the data is presented in the figure (Figure 1. Dynamics of the popularity of the "Online banking query"):
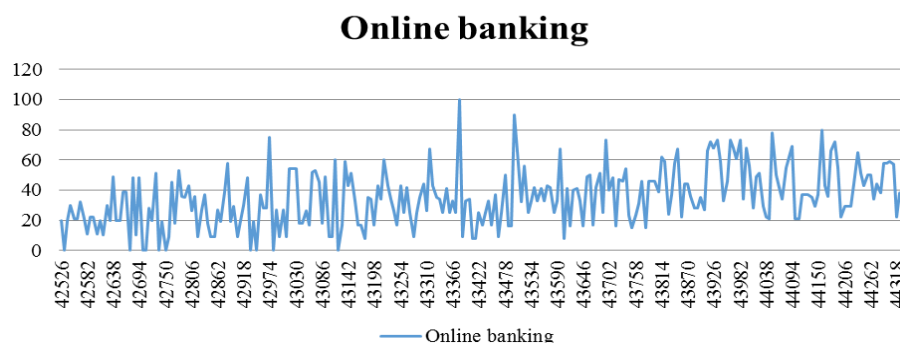
Online banking

Figure 1 Dynamics of popularity of the "Online banking" query

If the maximum number of search queries on the topic of interest was 1000, then exactly 1000 queries are accepted for 100 points. Accordingly, 500 queries will be equal to 50 points, 100 queries – 10 points, etc. The data analysis was carried out for a period of 5 years.

1. The Online banking query has been growing for five years. The peak of queries falls in August 2018. At the beginning of February 2019, they reached 100 points and 90 points, which demonstrates the interest of customers in digital services of Internet banks. In subsequent years, citizens also often show interest in Internet banks, while in May 2021 we note a trend of increased interest in the "Online banking" query.

The following figure shows the dynamics of the "Mobile payments" query over five years worldwide (Figure 2. Dynamics of the "mobile payments" query):
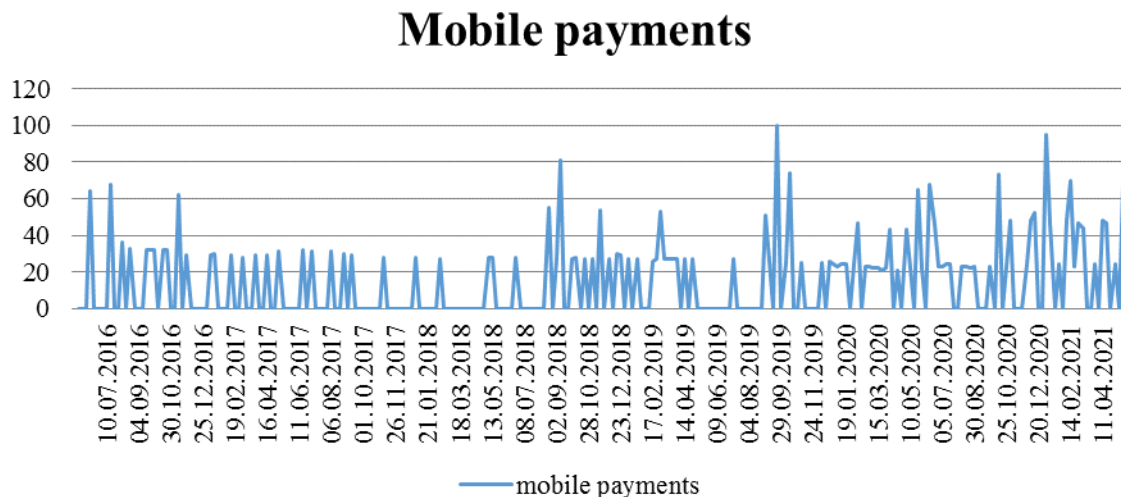
Figure 2 Dynamics of the "Mobile payments" query)

2. The "Mobile payments" query has also been showing abrupt growth for five years. Until June 2018, the maximum indicator was 68 points, an indicator of 81 points was recorded in September 2018. Then there were three more peak indicators in September 2019 – 100 points, in October 2020 – 71 points, in January 2021 – 95 points. It can be stated that the "Mobile payments" query is relevant at the moment.

The following figure shows the dynamics of the "Payment of fines online" query. Such payments are made using online applications of banks and show the demand for this digital service (Figure 3. Dynamics of the "Payment of fines online" query):

Payment of fines online
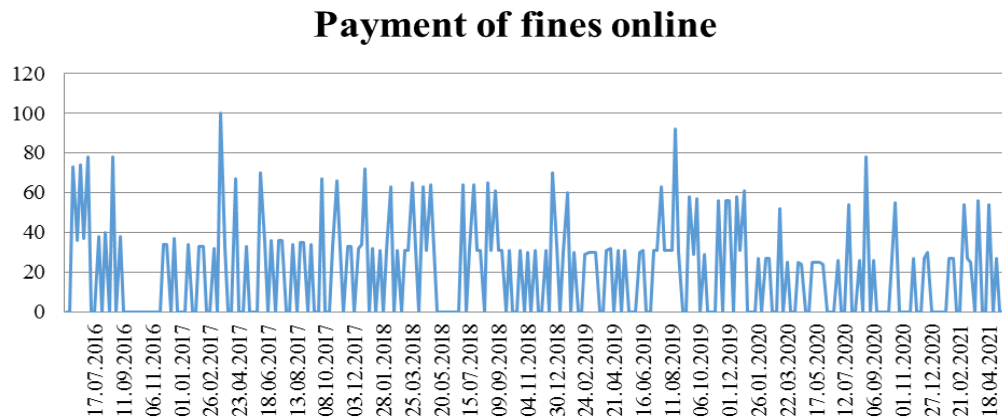
Figure 3 Dynamics of the "Payment of fines online" query

3. The "Payment of fines online" query demonstrates certain stability and peak patterns. The first peak of values was recorded in March 2017 and reaches 100 points, the second peak of queries fell in mid-August and amounted to 92 points, the third peak falls in August 2020 and is 76 points.

The dynamics of the "Credit online" query around the world is presented in (Figure 4. Dynamics of the "Credit online" query):
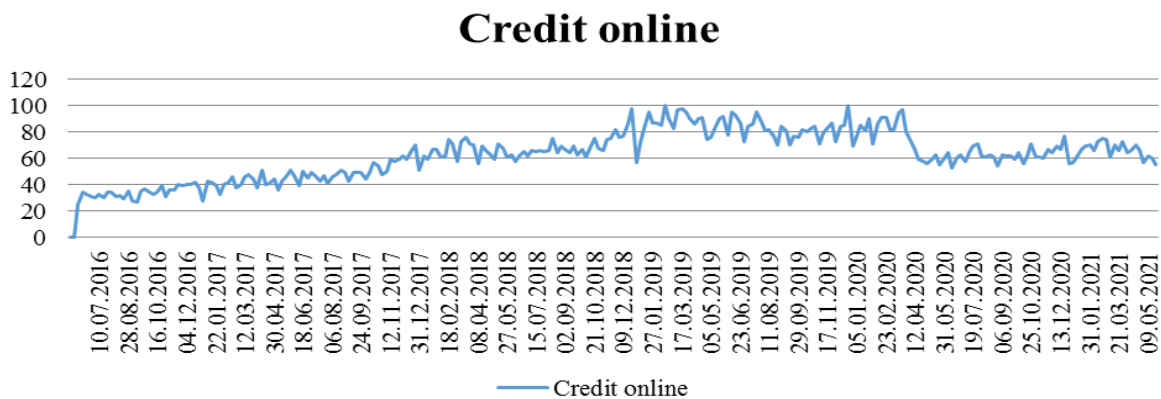
Credit online

Figure 4 Dynamics of the "Credit online" query

4. The "Credit online" query is characterized by an upward trend. The peak of queries falls at the end of 2018 and is 98 points, then the interest remains, but there is a slight decline in queries in May 2020.

The Yandex Wordstat service allows determining the exact number of queries for the desired words over the past three years. The functionality of the service used makes it possible to study the dynamics of queries only over three years.

impressions by the phrase internet bank
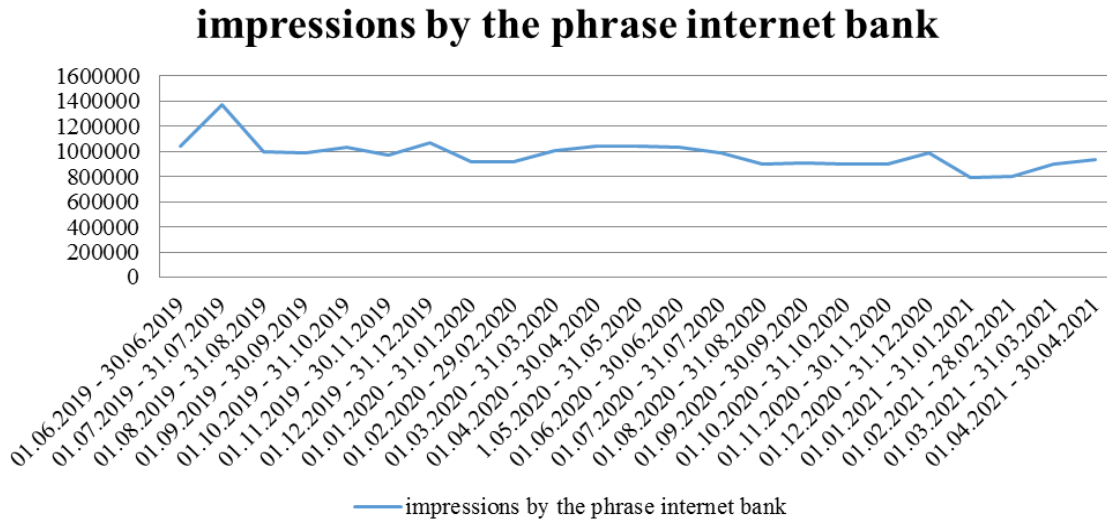
Figure 5 The history of impressions by the phrase Internet bank

The number of queries, according to Internet Bank, remained relatively stable during the study period. On average, users left 973,518 such queries per month in 2019, and in 2021 – 934,761 (-2%).

impressions for the phrase mobile payments
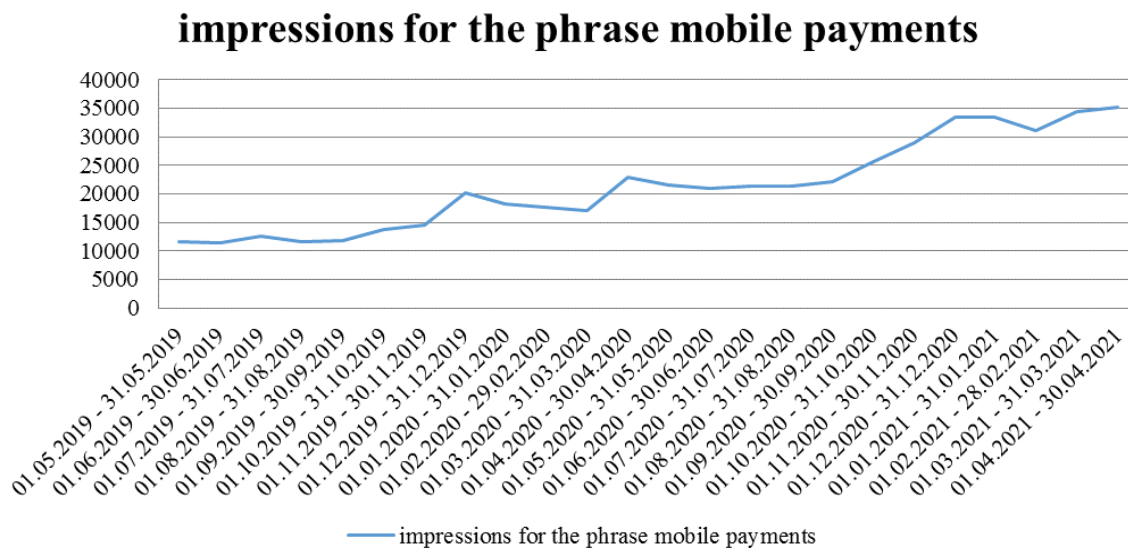
Figure 6 The history of impressions for the phrase mobile payments

The dynamics of the query for the phrase "mobile payments" shows rapid growth, the number of queries increased from 20,137 in 2019, to 35,246 in 2021 (+40%).
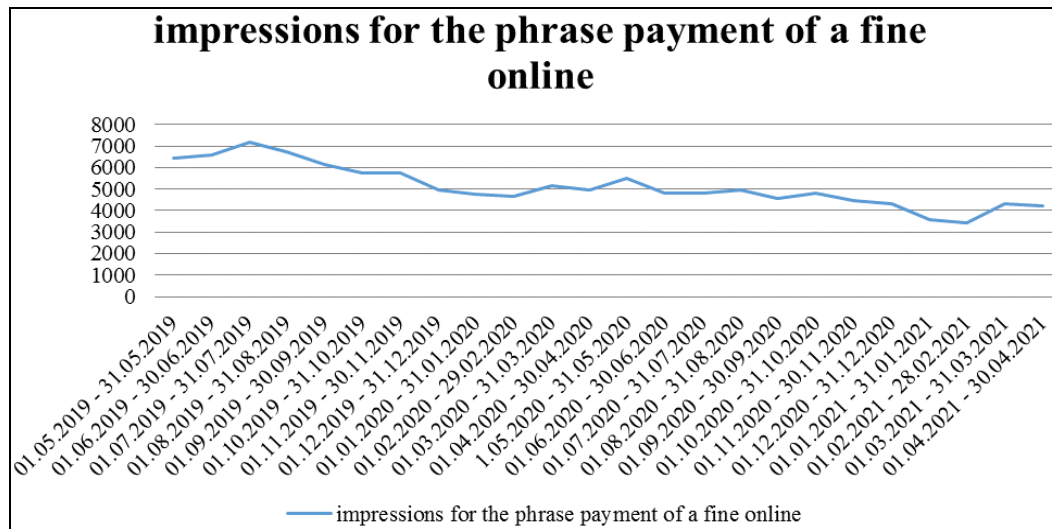
Figure 7 The history of impressions for the phrase payment of fines online
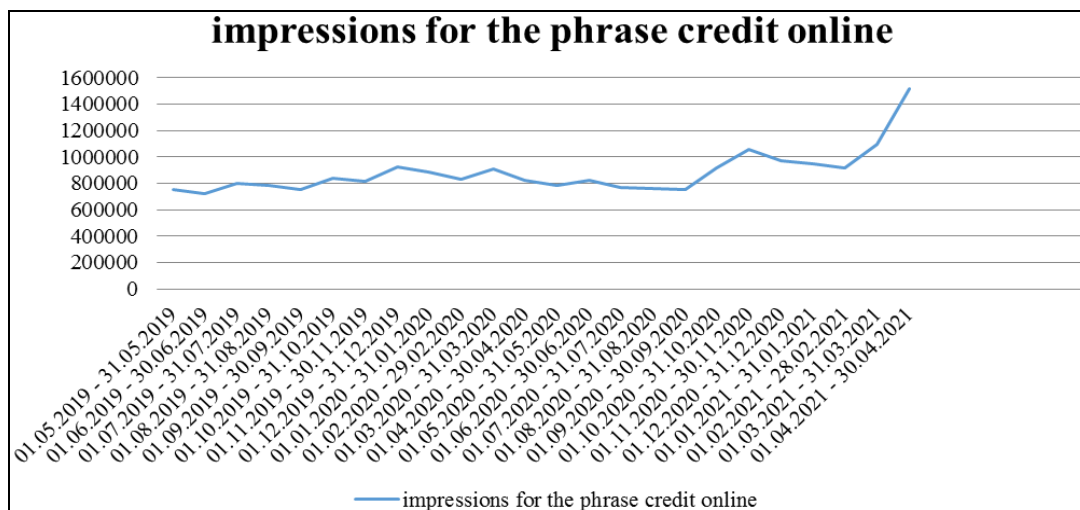
The "Payment of fines online" query shows stability and some downward trend, there are some seasonal peaks associated with tax periods.

Figure 8 The history of impressions for the phrase "credit online"

The dynamics of the "credit online" query demonstrate rapid growth. The number of queries increased from 927,822 in 2019 to 1,512,800 in 2021 (+62%).

Monitoring of cyberspace shows that the search for information related to online banks and loans online is the most popular one, the increasing number of search queries may indicate that digital banking services are in demand among the population. When determining the level of digitalization of a particular bank, it is necessary to take into account the level of automation of basic processes, including the number of online services provided to customers, such as opening a bank account; issuing a loan online;

transfers, and payments online; opening a brokerage account online; the number of online services provided to customers on the principle of the more, the higher the digitalization of the bank; the speed of online transactions; round-the-clock availability of online services; online sales and remote operations; a wide range of applied digital technologies such as Big Data technology, artificial intelligence, blockchain technology, machine learning, and smart contracts and others.

According to the surveyed reviewers, the use of digital technologies in the financial and banking sector leads to the optimization of many processes, while 68% of reviewers who are employees of banks that actively use digital technologies believe that the adaptation of customers to new technological processes in banking is associated with the development of online services and the provision of services remotely via the Internet, for example, citizens can use autopayments through their account online, open a bank deposit, issue a consumer loan and use other services that are performed online, without personal presence in the offices of Banks. Therewith, the use of innovations is evaluated positively. However, in addition to the positive aspects, 32% of respondents noted the negative consequences of the introduction of digital technologies in banking, which should include the reduction of bank branches and the release of labor resources, thus optimizing the banking sector through digitalization increases unemployment. According to statistics, in connection with the introduction of digital technologies in banking, the Italian group of banks Unicredit plans to close 400 branches from 2021, and Bank of America has already reduced its network by more than 500 branches since 2017, the French bank Societe Generale promised to abandon at least 200 branches by 2022, which will lead to the release of labor resources and indirectly increase the percentage of unemployed (Turki et al., 2020).
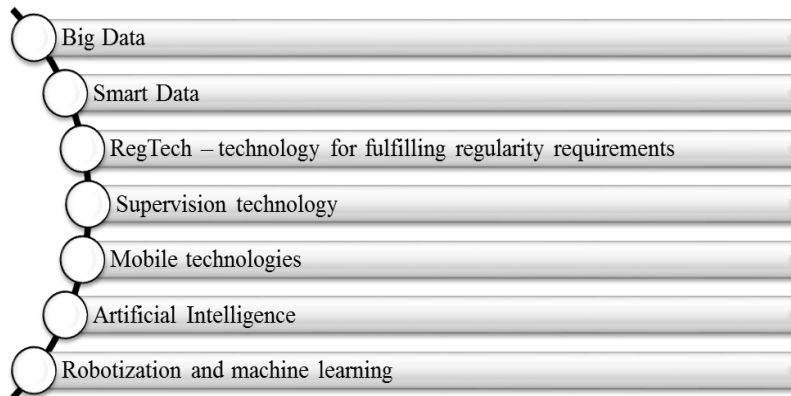
Discussion

The digitalization of banks can be classified into two types: the first characterizes the digital services used by customers, the second type is the range of digital tools used in the work of banks, which include artificial intelligence, blockchain, big data technology, and others.

At the international level, the financial and banking sector is moving towards remote interaction between customers and bank employees who use electronic services, which reduces transaction costs and allows them to use many banking services around the clock, regardless of the location of both the bank and the client (Khanboubi et al., 2019). Paper document management goes back in history, the task of remote identification of

customers is particularly important, for this purpose, many banks have created biometric databases containing unique characteristics of customers in digital form (Ramos et al., 2020).

According to experts working in the financial and banking sector, the most effective digital technologies used in the financial and banking sector include the following (Figure 9. Digital technologies used in the banking sector):

Big Data

Smart Data

RegTech – technology for fulfilling regularity requirements

Supervision technology

Mobile technologies

Artificial Intelligence
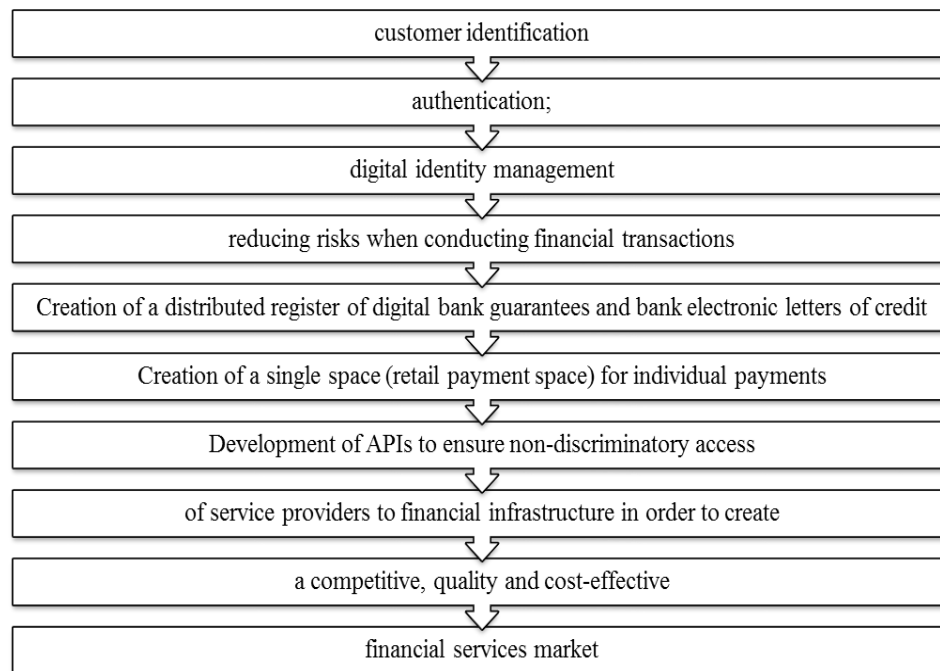
Robotization and machine learning

Figure 9 Digital technologies used in the banking sector

The use of digital technologies in the banking sector is based not only on these technologies. Robo-advising and crowdfunding technologies are used in many countries of Western Europe and the United States in addition to these technologies, and the technologies for the initial placement of tokens in countries that recognize cryptocurrency are used. Digital identification and authentication systems of individuals are widely used for the remote provision of banking services to customers, and unified systems for end-to-end digital identification of consumers are being created for this purpose (Alkhowaiter et al., 2020). The following technological platforms are used to create and develop the banking infrastructure (Figure 10. Technology platforms used in the banking sector):

Remote identification platform

Fast payment platform

Marketplace platform for banking services

Platform for registering banking transactions

National payment card system

Client Pass-Through IDклиента
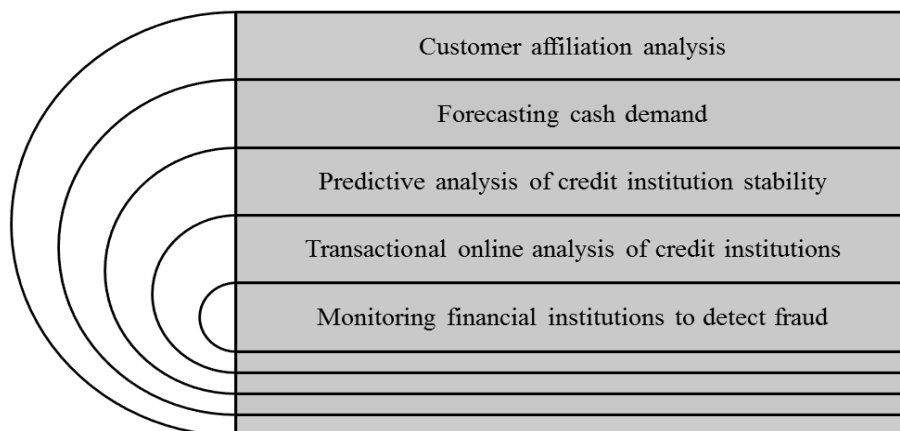
Cloud services platform

Figure 10 Technology platforms used in the banking sector

Digital blockchain platforms used in banking perform the following functions (Figure 11. Functions of digital platforms used in the banking sector):

customer identification
authentication;
digital identity management
reducing risks when conducting financial transactions
Creation of a distributed register of digital bank guarantees and bank electronic letters of credit
Creation of a single space (retail payment space) for individual payments
Development of APIs to ensure non-discriminatory access
of service providers to financial infrastructure in order to create
a competitive, quality and cost-effective
financial services market

Figure 11 Functions of digital platforms used in the banking sector

SupTech is the use of digital technologies by banks to automate administrative procedures. Supervision technology allows switching the interaction between the bank and the client into a digital format, increasing the reliability of the information, and optimizing the system for making effective decisions (He et al., 2020). SupTech uses Big Data technologies, artificial intelligence, cloud storage, robotics, blockchain, etc. Experts identify the following areas of **SupTech** decision-making (Figure 12. **SupTech** decision-making area):

Customer affiliation analysis
Forecasting cash demand
Predictive analysis of credit institution stability
Transactional online analysis of credit institutions
Monitoring financial institutions to detect fraud

Figure 12 SupTech decision-making area

Digital technologies are widely used in the banking sector – RegTech, which meet the requirements of government regulators to identify customers by biometric and other characteristics; on counteraction to fraudulent actions; on automation of the reporting, and compliance control. Machine learning technology is the creation of algorithmic code that is established by a machine with minimal human participation based on the analysis of similar actions, with the help of this technology it is convenient to work with a large amount of data. The machine learning algorithm is based on a statistical method, for example, the analysis of the issuance of consumer credit to a certain number of customers over a certain period allows machine learning to make a long-term forecast for lending based on data (Shaikh et al., 2017). Customer data is taken into account by machine algorithms to estimate the amount of the loan and all the risks of non-repayment – credit scoring. Interaction with customers is carried out by virtual programs and chatbots that not only interact with consumers but also contribute to early decision-making (Machkour, Abriane, 2020). The bank's capital is optimized and the margin that is formed due to non-repayment of loan funds by borrowers is optimized, as well as the effectiveness of the risk model in financial activities is evaluated using Machine learning technology and artificial intelligence (Cook, 2017). These technologies are particularly effective in the United States, Germany, the United Kingdom, China, and several other countries. Machine learning technology is used to process claims and a large array of data, identify risks, predict the optimal price value of insurance products by detailing and processing data received from customers (Chatzitheodorou et al., 2021).

Comprehensive source analysis (Van Der Horn et al., 2021; Saura et al., 2021; et al., 2021; Line et al., 2020) shows the merger of the banking sector with high-tech companies to implement new digital projects, for example, banks Barclays, Credit Suisse, Canadian Imperial Bank of Commerce, HSBC, MUFG, and State Street joined the Utility Settlement Coin (USC), to create a new digital currency USC (Kamdjoug et al., 2021). This currency was issued in 2016 based on distributed ledger technology by a Swiss Bank and differed from cryptocurrencies in the fact that it was linked to fiduciary currencies and central bank accounts, thus, financial institutions participating in this consortium could pay for securities with a new currency, without waiting for the receipt of fiduciary funds, this will seriously reduce costs and speed up transactions (Senyo et al., 2020). Thus, the digitalization of the banking sector is a large-scale phenomenon that affects the interests of every second adult inhabitant of the Earth.

Conclusion

A technological revolution is taking place in the financial and banking sector, which brings digital technologies and innovations to the first place. The digitalization of banks makes it possible to increase the speed of services provided, increase the security of transactions and make them more accessible to a wide range of customers. As the conducted research showed, the following facts must be taken into account when assessing the degree of digitalization of the bank:

- The level of automation of the main processes, including the process of interaction with customers;
- The number of online services provided to customers on the principle of the more, the higher the digitalization of the bank;
- Speed of online transactions;
- Round-the-clock availability of online services;
- A wide range of applied digital technologies, such as Big data technology, artificial intelligence, blockchain technology, machine learning, and smart contracts.

In addition, the main indicators of digitalization of banks are the volume of online sales and remote service operations, all these parameters allow assessing how effectively and to what extent digital technologies and innovations are used in a particular bank.

Scholars can consider which digital technologies are most promising in the financial and banking sector in subsequent studies.

Acknowledgments

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