Trends in the digitalization of the banking sector: an international aspect

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ABSTRACT

The study analyzes the main features of the use of digital technologies in the financial and banking sector at the international level. In the paper, we can conclude: the customer's digital identifier is the main attribute when using technology platforms in the banking sector; the norms on personal data protection and information security requirements should apply to the customer's digital identifier; since the digital identifier is analogous to a passport, we can say that the digital identifier can contain more information about an individual and allows to participate in digital civil turnover. The study proposes a method for assessing the degree of digitization of banks by the level of automation of key processes; by the number of online services provided; by the speed of transactions; 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 carried out using digital technologies.

1. Introduction

Currently, digital technologies are the key factor of the global development. The fast-paced 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 fields of activity.

Based on expert estimates, introduction and use of digital technologies can increase GDP in China up to 23% by 2026 and in the United States, the GDP growth can reach up to 2.3 trillion USD by 2026, a significant value growth generated by digital technologies is also predicted in Western European countries [1]. This forecast may be inaccurate due to the economic crisis amid the pandemic; however, the use of innovations contributes to the expansion of opportunities, releases labor resources, robotizes many processes, some techniques become fully automated and do not require human intervention.

Development of digital technologies in the banking sector promises scientific interest, since it is the most in-demand by the population and enterprises, citizens and legal entities constantly take loans, keep money on deposits, execute insurance contracts and use other banking services. Therefore, innovations used in credit-and-monetary relations are rapidly developing in a competitive environment, as they are forced to meet the requirements of consumers.

Above and beyond, protection against fraudulent activities is also linked to digital technologies, which are obliged to effectively protect funds entrusted by citizens and legal entities to banks.

2. Objective of the study

The main objective of the study is to explore the processes of digitalization of the financial and banking sphere at the international level and to identify markers determining the digitalization degree of a certain bank.

The main task of the practical importance is the development of an assessment method of the bank digitalization, nevertheless concurrently it is necessary to consider the following facts:

– the level of automation of main processes, including the process of interaction with the customers;

– number of services rendered to the clients, based on the principle, that is the more, the higher the digitalization of the bank;

– speed of online transactions;

– 24-hour availability of services online, availability of mobile version of personal account;

– a wide range of applied digital technologies such as big data technology, artificial intelligence, blockchain technology, machine learning, smart contracts and others.

3. Methods of problem solving and testing

In order to achieve the goal of the study, the works and reports on the introduction of digital technologies to the financial and banking sphere in Western European countries and the USA are analyzed; research articles on digital technologies in the financial sector are systematicly reviewed, 134 articles, including international publications are explored. Digital technologies most effectively used for optimization of interaction of banks with clients are studied; digital platforms used in financial and banking activities are categorized.

To obtain objective results, different analysis tools of Internet information space were used:

– "SiteSputnik" software, designed for automation and organization of professional search, collection, monitoring and analysis of information posted on the Internet

– search query analysis tools of "Google Trends" and "Yandex Wordstat";

– "manual" search on "Google" and "Yandex" search engines.

Technical part of the study, directly related to obtaining information from the Internet using both software tools and "manually", was carried out from September 6, 2020 to September 6, 2021.

The study of the information space on the Internet reveals that the majority of banks render digital services for their client. Followings are the services in

highest demand:

– "online-bank" mobile app;

– online payments and transactions;

– online loan granting;

– online payment of fines.

A statistical method and a method of measuring the activities of the organizations with the consideration to digitalization are applied. The results of the study show a link between the introduction of innovation and the reform of the financial and banking sector. The study aims to measure the benefits derived by banks from introduction of digital technologies and to identify the factors for measuring these benefits. Concern for security and standards is important for remotely (online) performed banking operations. A confirmatory analysis is conducted to assess the reliability and validity of the digital technologies used in the financial and banking sector. The results confirm that technologies such as a distributed ledger, neural networks, open interfaces, artificial intelligence are at the initial stage of incorporation into the activities of banks, while the digital banking services are in sought-after by the population and are in high demand.

4. Incorporation of obtained results

The World Economic Forum, held from 25 to 29 January 2021, stated that classical banking structures, such as universal banks, micro-financial organizations, investment banks, were undergoing the most rapid transformation [2]. This happened due to the need to introduce new digital technologies, update software and information systems. Accordingly, classic financial credit institutions are being transformed into high-tech platforms that are capable to create new profit algorithms using artificial intelligence, Big data technology and global database. Over time, such high-tech platforms will be capable to manage human resources and capital as a single set of capabilities.

On international level in the financial and banking sphere there is a transition to remote interaction of clients and bank employees who use electronic services, that reduces the transaction costs and uses many banking services 24 hours a day, regardless of the location of both the bank and the customer.

"Internet Bank" query demonstrates a leap growth globally. Data are presented in Fig. 1.

The maximum number of search queries on the topic of interest is 1000, whereas we count 1000 queries as 100 points. Accordingly, 500 queries will equal 50 points, 100 queries - 10 points, etc. Data analysis is performed for the last five years.

"Internet Bank" query has demonstrated growth in five years. Queries peaked in August 2018 and

early February 2019, when they reached 100 and 90 points respectively, pointing out the customer interest in digital services of the Internet banks. In the following years, citizens also often showed interest in Internet banks, while in May 2021 there was a trend of increased interest in "Internet banks".

The most effective digital technologies applied in the financial and banking sector are presented in Table 1. For example, the application of Big Five technology in banking (artificial intelligence, which creates a psychological type of personality based on the collected data) can generate up to 50 million USD in net profit per year.
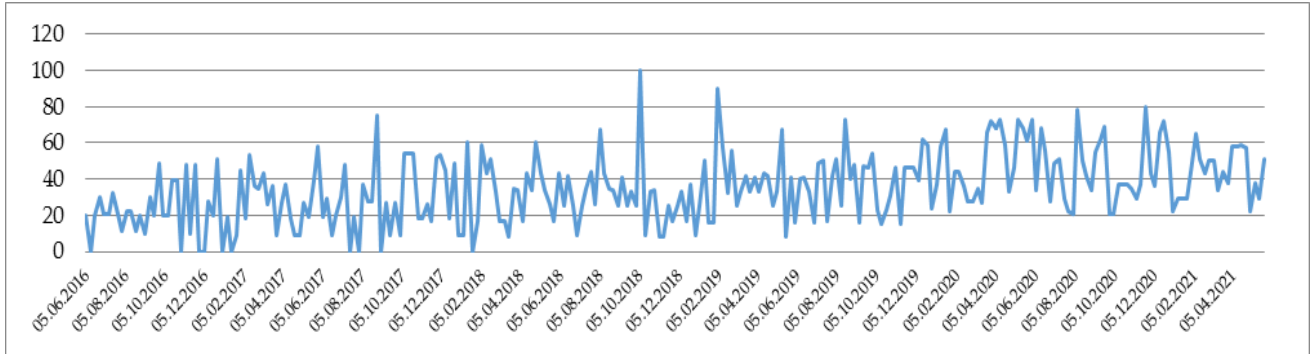

Figure 1. Popularity dynamics of "Internet-bank" query

Table 1. Digital technologies applied in financial-banking sphere

1.	RegTech – technology for meeting regulatory requirements
2.	Mobile technologies – mobile application for tablets, phones and laptops
3.	Application Programming Interface – application programming interface
4.	Big Data – Big Data technology
5.	Artificial intelligence, that replaces bank employees in the most resource-intense operations (Big Five technology)
6.	Internet of Things, IoT –used for collection and analysis of data in banking sphere
7.	Robotic automation and machine learning
8.	Biometrics used by banks to identify customers online, usually by voice and photos
9.	Blockchain – distributed ledger technology
10.	Open interfaces, allowing access to licensed software

Applying artificial intelligence in data analysis avoids many risks in the conclusion of transactions, as it considers characteristics of clients such as integrity, law-abidance, performance, emotional stability, reliability. Meanwhile, the use of artificial intelligence technologies, neural networks and other innovations does not exclude the activities of bank employees, but only optimizes them. Based on expert forecasts, the application of artificial intelligence in the financial and banking sphere is estimated to generate an additional revenue of 300 billion USD by 2030. Artificial intelligence has led to dramatic changes in banking. Particularly revolutionary is the fight against fraudulent activities, which is the main threat to the bank's customers. Artificial intelligence exceeds the abilities of the average person in many ways. If applied in banking operations, it can create a real revolution. Some researchers warn about the threat of artificial intelligence and its application. Therefore, it

is important to consider all the implications of digitalization and to be critical of certain processes.

Artificial intelligence is widely used in North America. According to the information of 2019, the banks were reported to be able to earn 15 billion USD through its application. With the course of such profit dynamics analysts predict up to 79 billion USD profit growth in the banking sector by 2030 [3]. Countries in the Asia-Pacific region are the leading users of artificial intelligence. Due to this technology, the banks are estimated to earn approximately 50 billion USD in 2024, compared to 11 billion USD in 2018. Use of artificial intelligence is believed to bring a 98 billion USD revenue to the banks in China, Japan, South Korea, and Singapore by 2030 [4].

The application of artificial intelligence can mostly affect the release of personnel such as

cashiers, employees of customer departments, clerks, financial managers, credit specialists and some other professionals.

Quite interesting research is performed by Deloitte consulting company, which determines the level of robotic automation in banks in different countries. The study concludes that many standard monotone actions are automated. For instance, about 59% of banks used artificial intelligence and robotics in 2019. Interviewed bank employees confirm that they use technologies for risk management - about 26%, report generating - 20%, working with customers - 34%, artificial intelligence and Big Data use - 40% [5]. The respondents also use cognitive analytics, business decision modeling technologies to improve the accuracy of calculations and reduce time spent.

In 2018, Bank of America conducted extensive research on the use of artificial intelligence in the financial and banking sector. It was initiated by the unstable situation in Europe, in particular in Italy, which could be a trigger for the development of the financial crisis. Artificial intelligence was supposed to predict the euro-dollar ratio. It used supervised learning when the machine analyzes human-tagged data and detects patterns. Cross-currency relations are difficult to forecast, so even the use of artificial intelligence in this area is unable to provide accurate forecasts unlike the stock market, which has been applying artificial intelligence for long and successfully. The Bank of America reports that at the global level, most banks have not yet been able to introduce artificial intelligence into their operations, however, at the same time the simplest methods are used by about 47% of banks around the world [6].

Application of digital technologies in the banking sphere is not only based on mentioned technologies. Along with these technologies, robo-advising technologies and crowdfunding is used in many countries in Western Europe and the US, and initial cryptocurrency coin offering technologies are used in the countries that recognize cryptocurrency (Japan, Switzerland, Singapore, USA, Canada, Denmark, Sweden, Germany, the Czech Republic, Norway). Attention must also be paid to the merger of the banking sector with high-tech companies for the implementation of new digital projects. For example, Barclays, Credit Suisse, Canadian Imperial Bank of Commerce, HSBC, MUFG, and State Street joined Utility Settlement Coin (USC) to create a new digital currency for USC. This currency was issued in 2016 based on distributed ledger technology by the Swiss Bank and differed from cryptocurrencies

as it associated with fiduciary currencies and central bank accounts. Thus, the financial institutions participating in the consortium could pay the securities in the new currency without waiting for the fiduciary cash to arrive. This greatly reduces costs and speeds up transactions.

Hard-copy paperwork is becoming history. The task of remote identification of clients is especially relevant. In this regard, many banks have created biometric databases containing the unique characteristics of customers in digital form. Systems of digital identification and authentication of individuals are widely used for remote provision of banking services to customers. In this regard, unified systems of end-to-end digital identification of consumers are being created. The end-to-end digital identifier of the client of the banking services sector must be regulated with the legislative acts to protect the legal rights and interests of citizens in the virtual space. Digital customer identity is the basic attribute utilized in banking sector technology platforms. The customer's digital identifier should be subject to personal data protection and information security requirements. Since the digital identifier was analogous to a passport, it could be said that the digital identifier could contain more information about the individual and enable him to participate in digital civil transactions.

The following technological platforms are used to create and develop banking infrastructure: platform for remote identification; fast payment platform; marketplace platform for banking services; platform for registration of banking transactions; national system of payment cards; end-to-end client identifier; platform for cloud services.

At the international level, digital technologies are being applied in the financial and banking sphere. For example, SupTech is the use of digital technology by banks for automation of administrative procedures. Supervision technology allows to transfer the interaction of the bank and the client into a digital format, increase reliability of information and optimize the effective decision-making system. Big Data technologies, artificial intelligence, cloud storage, robotic automation, blockchain, etc. are used within the framework of SupTech. The following areas of SupTech decision-making should be highlighted: customer affiliation analysis; cash demand forecasting; predictive analysis of the stability of credit institutions; transactional online analysis of credit institutions; monitoring of financial institutions with the purpose of detecting fraud.

RegTech digital technology fulfills the requirements of government regulators regarding

client identification by biometric and other characteristics, countering fraudulent activities, automating reporting and compliance control. Machine Learning technology stands for development of algorithmic code, which is created by the machine with minimal human involvement based on the analysis of the same-type actions. It is convenient to work with a large amount of data with this technology. For example, analyzing consumer loans issued to a certain number of customers over a certain period of time allows machine learning to make a long-term lending forecast based on data. Machine algorithms take into account customer data to assess the amount of issued loan and all non-repayment risks, that is loan scoring. Customer interaction is carried out by virtual programs and chatbots, which not only interact with consumers, but also contribute to the fastest decision-making. Machine learning and artificial intelligence technology optimizes the bank's capital and margins created by borrowers' loan defaults, as well as assessing the effectiveness of the risk model in financial activities. These technologies are particularly effective in the US, Germany, the UK, China and many other countries. Machine learning technology is used to process claims, process large amounts of customer data, identify risks, predict the optimal price of insurance products by detailing and processing the data received from customers [7].

Open Bank Project (OBP) technology is successfully used in the countries of Western Europe and the USA, this technology helps to disclose banking information to third parties, which allows to increase competition and availability of services. In 2015, the United Kingdom, with government support, used open bank data in nine of the largest banks, where most citizens are served. When using open banking technologies, banks are required to provide information about the accounts of clients to financial and technical companies, as well as provide access to clients' accounts.

Thus, the transfer of information is carried out via software applications implementing queries, giving certain commands, interacting with each other to obtain bank clients' data, and information exchange is carried out using the Application Programming Interface (API) [8]. The simplest example of using an API is a mobile bank, i.e., an application in the smartphone, using which bank customers can make payments, transfers, take out a loan, trade on the stock exchange and perform other actions, provided by the application's capabilities and the bank's specific policy.

An increasing number of organizations operating in the financial and banking sector use open banking technology, which creates certain advantages for both customers and banks. Most recently, thanks to open bank data technology, customers have been able to track information on their accounts placed in different banks with the help of one application. Such an application is called multi-bank.

Previously, it was necessary to install several applications, i.e., for one for each bank separately. For example, one application for Sberbank, another application for VTB, etc., which created some difficulties for clients.

The main advantages of multi-bank applications include: online balance monitoring in their accounts in different banks; selection of an account for payment operations; comparison of credit conditions (rates, maturities, amount of funds provided, etc.) in different banks.

Banks also benefit from open access to banking APIs. Open access allows the banks to attract customers in a competitive environment, as well as receive information about trends in the field of financial services. Thus, customers choose banks that provide loans at a reduced rate, placing funds in deposits at a higher rate. Banks in a competitive environment are guided by the preferences of customers.

Let's review how API technologies are used in Western European countries and USA in the financial and banking sector. In 2018, the European payment directive PSD2 (Revised Payment Services Directive, or the second payment directive) was adopted in Europe, which, in fact, marked a revolutionary change in integration policy of banks. This way, in accordance with this directive, banks must provide information about the customer base to third parties using APIs, which will increase competition in the market for mobile applications and startups [9].

There is no government regulation in the field of application of the API in banking in the US. However, back in 2016, a banking aggregator was developed that allowed to transfer client base data of US and Canadian banks to third parties [10].

The Special Monetary Authority was established in Singapore with the support of the Association of Banks in Singapore. It supported the use of open banking technologies. The approved document of Finance-as-a-Service confirmed the need to exchange financial information between banks. The priorities of introduction and use of innovative projects in the banking sphere, including projects that allow to customer account data exchange with third parties, were also added.

Third parties should be understood as technology companies rendering software support [11].

FinTech Smart Association was established in Russia, which is engaged in the promotion and development of financial technologies. However, the use of the open API in the banking sector is in nascent state. The country's largest banks, such as Sberbank (formerly the Russian Savings Bank), VTB, Gazprombank, declared their readiness to use new start-ups, including open APIs. We can note the pilot project of the Bank of Moscow implemented with VTB in the form of an open ecosystem, that allows partners to connect remote services to bank programs. The created Unified Payment System allows third-party partners to embed financial services in their own applications and thus cooperate at the digital level. A statistical study conducted by Markswebb in Russia points out that 35% of consumers of financial services use the mobile application of various banks, and it is not only young citizens - the age of users varies from 18 to 70 years. Thus, 36 million people have a mobile application of one or more Russian banks [11].

In addition, the main indicators of the digitalization of banks are the volume of online sales and performance of service operations. All these parameters allow to assess the effectiveness and extent of digital technologies and innovations used in banking services.

Let's review digitalization indicators on the example of the Russian Sberbank, which is leading in the level of application of digital technologies. Table 2 presents the main indicators of application of digital services and technologies [12].

Table 2. Digitalization Indicators of Sberbank of Russia

№	Digital opportunities	Implementation level
1.	Automation level of basic processes, including customer interaction process	Basic services are available online
2.	Number of online services rendered to the customers	Payment for purchases with a QR code directly in the application, transferring money, opening and replenishment of a deposit and a brokerage account, taking out a loan, online consulting, online-registration of a business
3.	Speed of online transactions	up to one minute, with exceptions
4.	Accessibility of online services	24 hours
5.	Range of applied digital technologies	Big data technology, Big data technology, capture technology, feedback interfaces, data optimization technology, artificial intelligence, blockchain technology, machine learning, smart contracts

Data provided in the table clearly demonstrate that the digitalization of Sberbank of Russia services is quite high, while the Bank continues to actively apply digital technologies, expanding the range of their use.

The application of digital technologies in the financial and banking sphere leads to the optimization of many processes, while the adaptation of customers to new technological processes in banking activities is connected to the development of online services and the provision of services remotely via the Internet. For example, citizens can use auto-payments through their online accounts, open a bank deposit, take a consumer loan and benefit from other online services without being personally present in banks' offices. The use of innovation is assessed positively.

However, in addition to the positive aspects, there are negative consequences of the introduction of digital technologies into banking activities, which include the reduction of bank branches and the release of labor force. Thus, the optimization of banking sector through digitalization contributes to an increase in the unemployment rate. According to statistics, due to the introduction of digital technologies in banking activities, Unicredit, the Italian group of banks, plans to close 400 branches from 2022, and Bank of America has reduced its network by more than 500 branches since 2017, about a million bank employees became unemployed. The French bank Societe Generale promised to close down about 200 branches by 2022; it is planned to reduce 500 jobs in the UK, which will release labor force and will indirectly increase the unemployment rates. [13].

The financial and banking sector is witnessing a technological revolution that puts digital technology and innovation first. The digitalization of banks increases the speed of provided services, increase the security of transactions and make them more accessible to a wide range of customers.

5. Conclusion

The study revealed that a wide use of digital technologies and innovations provides the financial and banking sector with following advantages: maintains the competitiveness by attracting customers who use digital bank services for remote

rendering of services; improves the interaction between the bank and customers; promotes the ability to attract customers from any region; provides more opportunities while performing banking activities during online interaction with the client; enhances the effectiveness of monitoring of financial transactions; reduces the cost of services by reducing the charges of all participants in financial relations; contributes to the formation of the bank's image as innovative, modern, digital, which inevitably increases its rating.

Digital blockchain platforms used in banking activities perform the following functions: customer identification; authentication; digital identity management; reducing risks in financial transactions; creation of a distributed ledger of digital bank bonds and electronic letters of credit; creation of a single space (retail payment space) for payments by individuals; development of an API to ensure non-discriminatory access of service providers to financial infrastructure to create a competitive, high-quality and cost-effective financial services market.

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