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Financial Support for Small and Medium-Sized Enterprises in China Amid COVID-19

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ABSTRACT

Small and medium-sized enterprises (SMEs) are vital drivers of China's economy. As in any other country, SMEs in China are exceptionally exposed to the devastating effects of the COVID-19 outbreak. The **aim** of the paper is to assess the impact of the pandemic on SMEs in China and study the effectiveness of the government's support for SMEs through the crisis. The **methodologies** applied by the authors included the historical and logical method, the method of the rising from the abstract to the concrete, synthesis, comparative factor analysis, grouping and graphical methods, as well as a systematic and statistical approach. The authors investigate the main policies and initiatives launched in support of smaller businesses and implemented by the People's Bank of China, the Ministry of Finance, the National Development and Reform Commission, the Ministry of Industry and Information Technology, as well as by the two national regulatory authorities — China Banking and Insurance Regulatory Commission and China Securities Regulatory Commission. In this paper the authors analyze the direct and indirect support available to SMEs through financial institutions. The study leads to the **conclusions** that the state support for SMEs has been effective and helped to avoid a sharp decline in production. However, the spread of the disease in other countries may threaten the recovery of the Chinese economy.

Keywords: SMEs; COVID-19; financial institution; anti-crisis policy; guarantee; capital assets

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INTRODUCTION

The continued spread of coronavirus disease 2019 (COVID-19) has led to delayed resumption of work, traffic control, business closure and restrictions on population movement in many provinces and cities, which have a significant impact on national economic growth in the short term, especially for small and medium-sized enterprises (SMEs) that are strongly associated with economic fluctuations. As an important part of the real economy, SMEs are also an important source of impetus and vitality for the growth of the national economy. Under the impact of the epidemic, the capital flows of SMEs have broken down, and their operational risks have increased sharply.[1]

As an important regulatory tool to boost economic development and maintain social stability, finance can play a key role in risk mitigation for SMEs in crisis management. China's current level of financial development is still low, SMEs need more financial support but difficult to obtain financial funds sufficiently. In line with the principle of serving the real economy and preventing the occurrence of systemic financial risks under the impact of the epidemic, the state has introduced a series of financial assistance policies for SMEs in the form of government intervention "financial rescue". At the same time, the People's Bank of China and the financial regulatory authorities have successively introduced a number of policies to enhance the financial service capacity of financial institutions to achieve the dual objectives of guiding capital flow into the real economy and maintaining financial stability.

This paper will sort out relevant policies issued by the government, understand the purpose and effect of relevant policies, and analyze the future development direction of China's economy under the support

[1] Research Group of Ping An Inclusive Finance Research Institute. Do a Good Job in SMEs Financial Services under the Impact of the Epidemic. China Finance. 2020;(5)44–45.

of various policies. The following arrangements are as follows. First, expound the impact of coronavirus on China's economy, mainly on SMEs. Second, introduce the financial assistance policies provided by the government to SMEs. Third, introduce the financial support policies of the government for financial institutions to prevent the risks of the real economy from being transmitted to the financial system.

THE IMPACT OF THE EPIDEMIC ON THE ECONOMY

The Impact of the Epidemic on the Macro Economy

According to the theory of economic growth, the epidemic is not an endogenous factor of economic growth, the decisive factors are labor, capital and technology. But the panic emotion, change of expectation and restriction measures brought by the epidemic will change people's consumption and investment behaviors, thus affecting the macro economy [1]. According to J. Lee and W. J. Mckibbin (2004) [2], the epidemic can affect economic development in three ways. First, the consumption downturn caused by the fear of infection, especially in tourism and retail industry. Second, is to make people feel uncertain about the future economic development through the way of expectation. Third, the epidemic has increased the cost of disease prevention. At present, China's economy is under the attack of unprecedented structural factors (the transformation of old and new drivers of growth, the restructuring of global industrial and value chains) and cyclical factors (the global spread of COVID-19, the collapse of commodity prices and the violent turbulence of financial markets). The impact of COVID-19 will bring great challenges to economic development.[2]

In spite of the change of temporary decisions of consumers and investors caused by epidemic, the driving forces of domestic economic development remain unchanged, and the virtuous circle of economic efficiency improvement, market potential release, consumption and industrial transformation and upgrading will keep the same. As a result, the domestic economy has not changed in the medium to long term. Some scholars also believe that in the long-run, catastrophic impacts such as the epidemic will bring impetus to the birth of new technologies and the renewal of capital stock, thus improving the long-term total factor productivity [3, 4]. Z. Q. Li (2003) [5] takes the SARS as an example, to analyze its influence on the national economy, in the short term the outbreak really has a huge impact on consumption industries, thus bring short-term economic fluctuations. However, in the long-run, the outbreak will induce some formal and informal social changes, and improve the efficiency of resource allocation in the long run, which is conducive to economic growth.

Unlike major natural disasters, COVID-19 does not destroy the material basis of economic production. It reduces or delays short-term demand, but does not harm long-term demand. It severely suppressed the consumption demand, but did not hurt the investment demand. Local impact on the worst-hit areas is large, but the overall impact on the country is limited. According to the preliminary calculation by the National Bureau of Statistics, the GDP of the first quarter of 2020 was 2.0554 trillion yuan due to the epidemic, down 6.8% year-on-year, of which the value-added of the primary industry was 1018.6 billion yuan, down 3.2%. The value-added of the secondary industry was 7363.8 billion yuan, down 9.6%. The value-added of the tertiary industry was 12 268 billion yuan, down 5.2%. Since the second quarter, as the spread of the epidemic in China being basically interrupted, the resumption of work and production has been accelerated. Basic industries and important products related to the national economy and people's livelihood have been growing steadily, the basic livelihood of the people has been well protected, and overall economic and social development has been stable. Additionally, the consumption and investment that postpones earlier can have release, national economy can appear compensatory recovery. It can be sure that the impact of the epidemic on China's economy will only be temporary and the fundamentals of China's economy will remain stable and sound [6]. Experience shows that the suppression of consumption and investment by the Ebola virus, Middle East Respiratory syndrome and SARS in 2003

[2] China Economic and Financial Research Group, Bank of China Research Institute. In Response to the Severe Impact of COVID-19, Decisive and Drastic Policy Adjustments are Needed-Bank of China Economic and Financial Outlook Report (Q2 2020). *International Finance.* 2020;(4):51–59.

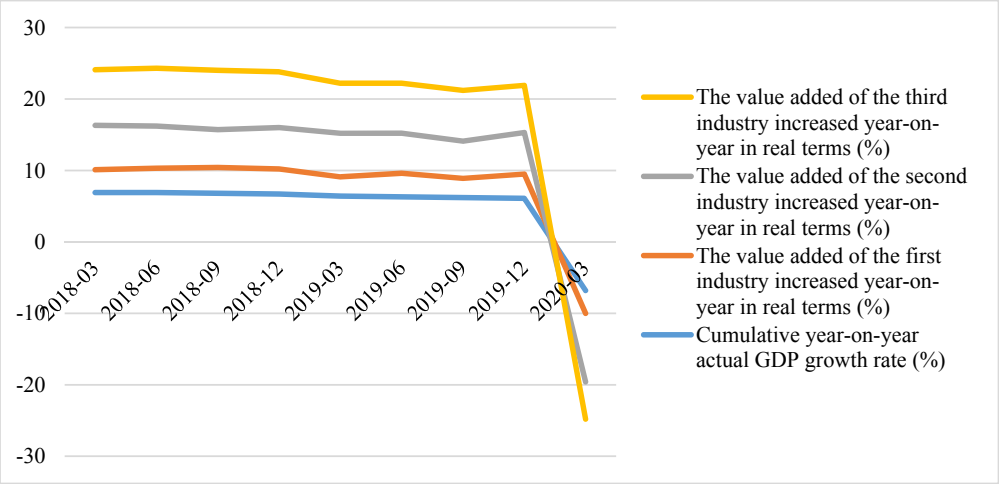

Fig. 1. **Quarterly growth rate for GDP and three industries**

Source: compiled by the authors.

is usually temporary, and after the epidemic is effectively controlled, the suppressed economic activities such as consumption and investment quickly rebound, demonstrating the economy's ability to repair itself [7]. However, in the short term, the epidemic will still affect the real economy in four ways [8]. First, due to the spread of the epidemic, the resumption of work after the Spring Festival has been delayed, resulting in the temporary idling of production capacity. Second, the epidemic has led to pessimistic expectations of investors on the economic outlook, lower commodity prices, and weakened the power of enterprises to expand and increase inventories. Third, due to the epidemic, the demand for logistics, catering and other service industries decreased sharply in the short term, and the industrial manufacturing industry was affected through the relevant industrial chain, and the supply side contracted. Fourth, the operation of SMEs is severely damaged, facing a severe survival crisis, and easy to cause employment problems [9] (See *Fig. 1*).

The Impact of the Epidemic on SMEs

Although the epidemic will not cause huge losses to China's long-term economic development, it has dealt a near-fatal blow to the development of many SMEs. The survival and resumption of work of SMEs has become "a major priority" in the current economic development [10]. The Business Model Innovation Research Center of Tsinghua University recently conducted a survey for SMEs, and a total of 995 SMEs participated in the questionnaire feedback. According to the survey data, 34% of enterprises can only last for one month, 17.91% can last for three months, and only 9.96% of enterprises can last for more than six months.[3] SMEs have inherent vulnerability, and their low risk resilience has made them the first to bear the brunt of the epidemic. The investigation conducted by Zhu et al. (2020) during the epidemic period also showed that 85.8% SMEs had a capital maintenance capacity of less than 3 months. If the enterprises could not receive timely policy support and assistance during the epidemic prevention process, a large number of SMEs would face the risk of bankruptcy [10].

In fact, before the outbreak of the epidemic, the financial chain of SMEs was already under strain due to the double impact of the global economic slowdown and China-USA trade frictions. By the end of 2019, the accounts receivable balance of private industrial enterprises, represented by SMEs, accounted for 31.3% of current assets, the highest since data records began, presenting a high liquidity risk [11]. For the sudden outbreak of COVID-19, prevention and control of the flow of people and goods have been tightly restricted both at home and abroad, business's determination to keep factories and workers idle and systemic economic stagnation, impact resistant ability of SMEs. Especially for SMEs in the physical

[3] The data comes from the Report of 995 SMEs jointly investigated by Tsinghua University and Peking University published by China Europe Business Review on February 5, 2020.

retail, tourism, transportation and logistics industries that have been heavily affected by the epidemic, not only have financial obligations to pay the wages, rent, inventory and cost of loan principal and interest, but also face sales revenue loss, supply chain, and capital chain rupture. Small businesses have been hit hard, facing serious survival crisis. According to the survey data of China Merchants Bank (90.4% of the interviewed enterprises are SMEs), 24.7% of the sample enterprises are seriously affected by the epidemic, among which 16.9% are in trouble and 5.8% are facing the risk of bankruptcy.

SMEs in China have lots of typical characteristics of "Five-Six-Seven-Eight-Nine". They make more than 50% of the contribution to the national tax, more than 60% of GDP, more than 70% of the technological innovation, more than 80% of the urban labor employment, and in terms of numbers, small businesses account for 90 percent of the country's businesses.[4] Therefore, SMEs are the major force of national economic and social development, and an important basis for improving people's livelihood and ensuring employment. To ensure the resumption of work and production of SMEs and tide over the epidemic situation is the prerequisite for the national economy to achieve self-repair.[5]

Financial Support under the Epidemic

For the financial market, it faces two daunting tasks. First, to give full play to the role of the financial sector in serving the real economy, comprehensively strengthen financial services for epidemic prevention and control, and provide financial support for the development of enterprises under the epidemic. Second, to maintain financial stability, increase the risk tolerance of the financial system, and mitigate the credit risks and even systemic financial risks of financial institutions. The focus and difficulty of "financial rescue" lies in finding a balance between the two tasks, which not only ensures that SMEs can get enough financial support and get out of trouble smoothly but also maintains the safety of financial institutions and the stability of financial markets and prevents systemic financial risks.

Financial Support Policies for SMEs

For a long time, China's SMEs have been faced with the problem of difficult and expensive financing. Due to their small scale, poor mortgage ability, and the general problem of information asymmetry, the future development of SMEs has great uncertainty. In order to prevent their own risk and to meet the regulatory requirements, formal financial institutions, dominated by banks, adopt a negative attitude or even credit discrimination towards the financing of SMEs, or raise the financing costs of SMEs by charging high risk compensation. At the same time, due to the imperfect capital market in China and the high financing threshold in the direct financing market, most SMEs are difficult to meet the requirements. Therefore, the financial support needed in the development process of SMEs is either absent or is a mere formality [10]. China's SMEs mainly rely on endogenous financing, and the constraints of their own capital make them easily fall into the development dilemma. It is evident that SMEs in the original macro environment are in urgent need for financial support. Under the impact of the outbreak, SMEs are bound to suffer from liquidity, financing constraints, and the cost of financing and other multiple test and pressure, lead to further deterioration such as its operating conditions, and even lead to business failures. SMEs are in urgent need of financial support with government intervention.

Since the outbreak of COVID-19, the government has given greater priority to supporting the development of the real economy by increasing credit supply, reducing financing costs, and introducing special relief policies to support SMEs and individual businesses, which have given strong support to the prevention and control of the epidemic and the resumption of work and production of SMEs [12]. The cores of the policy are entrenched in two ways. One is to help enterprises to solve the problem of cash flows. The other is to help enterprises to repair credit losses. Among them, the Ministry of Industry and Information Technology issued the Notice on The

[4] According to statistics from the State Administration for Market Regulation, by the end of 2019, there were 123 million market players nationwide, among which 38.583,000 were enterprises and 82.61 million were self-employed.

[5] The source is from the first meeting of the State Council Leading Group for Promoting the Development of SMEs, held on 20 August 2018.

Work related to Coping with the COVID-19 Epidemic to help SMEs to resume work and production and tide over the Difficulties (Notice 14 of MIIT), which includes the financial support for SMEs in a relatively comprehensive way, specifically in the following aspects.

INCREASE CREDIT SUPPORT

The government is required to urge financial institutions to appropriately reduce loan interest rates, increase credit loans and medium and long-term loans to SMEs that have development prospects but temporarily encounter difficulties due to the epidemic, and refrain from blindly withdrawing, cutting or pressuring loans. If it is difficult to repay the loan at maturity, the loan shall be extended or renewed. In order to solve the information asymmetry problem of SMEs, a new credit investigation model based on multidimensional big data analysis can be promoted to improve the credit score and loan availability of high-quality SMEs. At the same time, we will provide emergency lending support to enterprises that are greatly affected by the epidemic. We will encourage localities where conditions permit to set up loan risk compensation funds and appropriately compensate the non-performing loans granted by financial institutions to SMEs during the epidemic.

Strengthen Financing Guarantee Services

Under the new normal of the economy, private guarantee companies have a high rate of bad debts and are struggling to survive. At present, it mainly relies on government-backed guarantee companies to solve some financing problems of SMEs (Guo Na, 2013). The government needs to guide government-managed financing guarantee and re-guarantee institutions at all levels to improve their business efficiency and reduce the rates of guarantee and re-guarantee. For those SMEs that are really unable to repay, government financing guarantee institutions at various levels providing financing guarantee services for them should fulfill their obligations of compensation in a timely manner, and appropriately extend the time limit for recovery according to the impact of the epidemic situation. If the debt of SMEs meets the conditions for cancellation, it will be written off and losses will be compensated in accordance with regulations.

Innovate Financing Products and Services

Actively promote the use of supply chain finance, commercial factoring, accounts receivable pledge, intellectual property pledge and other financing methods to expand the financing supply for SMEs. We should give full play to the convenience and speed of Internet finance, and develop financing products suitable for SMEs during the epidemic as soon as possible to meet their needs. We will give full play to the role of financing service platforms for SMEs across the country, and actively carry out docking among governments, banks and SMEs online. Coordinate with banks and insurance institutions to open the green channel for credit and insurance claim settlement, and speed up lending and claim settlement.

Accelerating Equity Investment and Services

We will give full play to the synergic effect of national and local development funds for SMEs, encourage private capital to expand equity financing for SMEs, and encourage more investment in innovative and growing SMEs that are temporarily in difficulty due to the epidemic in order to speed up investment. We will guide all kinds of funds to give full play to their platform and resource advantages, increase post-investment services for the companies that are heavily affected by the epidemic, and coordinate various resources such as financing, talent, management and technology, to help them tide over the difficulties.

In China's bank-dominated financial system, the current financial support for enterprises are mainly the credit support from banks. According to a series of preferential credit policies for SMEs issued by China Banking and Insurance Regulatory Commission, including increasing the supply of credit, lower loan interest rates, for overdue loan renewal, etc. under the impact of COVID-19, non-performing loans due to the impact of the epidemic should be exempted from accountability, the government should encourage banks to increase the non-performing loan ratio of SMEs, increase the independent write-off of non-performing loans, adjust the assessment indicators

or adjust the assessment weight, and stimulate and increase the enthusiasm of grassroots banks to dare to lend to SMEs. Local governments have also introduced credit enhancement measures to help enterprises lend for the first time and renew loans, and to expand the credit benefits of SMEs. However, credit policies are mainly aimed at enterprises that meet the bank credit conditions, or some enterprises that meet the bank credit conditions after the credit edge and government credit enhancement, which cannot benefit the vast majority of SMEs [15]. Moreover, for a large number of enterprises, the most needed is not debt financing but equity financing: debt financing will increase the cash flow burden of enterprises' debt servicing, worsen their financial strength, which is more vulnerable due to the impact of the epidemic, and increase the risk of financial crisis. Therefore, the Notice 14 of MIIT also stressed the use of equity investment or other innovative financing way to boost the survival and development of SMEs, such as guiding the social capital and all kinds of equity investment fund of SMEs, bank credit, equity investment and loan linkage, developing and perfecting the capital market to guide more capital "blood transfusion" for SMEs (See *Table*).

Policy Support for Financial Institutions

At the same time, the epidemic has also had an impact on financial institutions represented by banks, and preventing systemic financial risks is also an issue that regulators attach great importance to [13]. First of all, the COVID-19 outbreak has disrupted the normal operation of banks and other financial institutions, resulting in the postponement of the original business plans of banks. Secondly, the significant impact of COVID-19 on enterprises has affected the normal credit supply of banks, which may lead to potential operational and liquidity risks. What is more noteworthy is that the difficult situation of SMEs affected by the epidemic has made commercial banks, especially SMEs banks, facing serious asset quality risks [14]. On the one hand, the impact of the epidemic has led to the collapse of a large number of SMEs. Although it is conducive to market clearing in the long term, it is very easy to cause credit risks in the banking industry in the short term [15]. On the other hand, SMEs have a high degree of information asymmetry. Driven by continuous policies, the proportion of SMEs' customers in commercial banks keeps rising, which makes post-loan management difficult for Banks and further aggravates credit risks faced by banks.

People's Bank of China, the China Banking and Insurance Regulatory Commission and other financial departments have issued a series of policies that aimed at preventing and controlling the impact of the epidemic on banks to enhance their credit supply and resist risks so as to create a favorable policy environment for financial institutions, strengthen the support for SMEs, and reduce the capital cost of the real economy.

The central bank's policies mainly include. Firstly, carrying out reverse repos to provide sufficient liquidity to the financial market. For example, on February 10, 2020, the central bank conducted 900 billion yuan of reverse repos through interest rate bidding. Secondly, targeted RRR cuts will be implemented for SMEs banks with a high proportion of investment in SMEs. In April and May, the Central bank cut the required reserve ratio by 1 percentage point for rural financial institutions and urban commercial banks operating only in provincial administrative regions, releasing about 400 billion yuan of long-term funds, effectively increasing the stable source of funds for banks to serve the real economy and reducing their funding costs. Thirdly, providing accurate support for refinancing and rediscount. In response to the epidemic, the central bank set up 300 billion yuan of special re-loans for epidemic prevention, more than half of which will be invested in SMEs. Subsequently, the central bank extended another 500 billion yuan in new loans and discounts to support the resumption of work and production of SMEs. In April, the central bank continued to increase the refinancing quota of 1 trillion yuan, also giving priority to SMEs. Fourthly, cut the excess deposit reserve ratio. The central bank cut the interest rate on excess reserves that financial institutions hold at the central bank from 0.72 percent to 0.35 percent on April 7, the first cut since 2008, in an effort to guide Banks to park less excess funds at the central bank and use them more to support the real economy. Before the outbreak, China Banking and Insurance Regulatory Commission requirements for commercial banks to set aside the coverage range

Table

Summary of major credit support policies during COVID-19

Time	Department	Related Policy	Main Content
1 May	People's Bank of China, Ministry of Finance, China Banking and Insurance Regulatory Commission, China Securities Regulatory Commission, State Administration of Foreign exchange (SAFE)	Notice on Novel Coronavirus Pandemic Prevention and Control with Further Strengthening Financial Support	Ensure the total supply of credit, increase credit support for COVID-19 prevention and control, and provide differentiated and preferential financial services to regions, industries and enterprises that heavily affected by the pandemic
1 March	Banking and Insurance Regulatory Commission, People's Bank of China, National Development and Reform Commission, Ministry of Industry and Information Technology, Ministry of Finance	Notice on Temporary Extension of Principal and Interest Repayment for Loans to SMEs	According to the actual situation affected by the pandemic, enterprises are given a certain period of deferred interest payment arrangement
31 March	Banking and Insurance Regulatory Commission	Notice on the Promotion of "Incremental Expansion, Quality Improvement and Cost Reduction" of Financial Services for SMEs in 2020	Make good use of the targeted RRR reduction policy for inclusive finance, reasonably determine the loan interest rates for SMEs, and reduce the overall financing costs of loans to SMEs
7 April	Banking and Insurance Regulatory Commission	Notice on Make Full Use of the Role of "Banking-Taxation Interaction" to Help SMEs Resume Work and Production	In view of the more urgent financial needs of SMEs during the pandemic, increase support for tax credits and loans to help enterprises to resume work and production and overcome the difficulties
1 June	People's Bank of China, Banking and Insurance Regulatory Commission, Ministry of Finance, National Development and Reform Commission, Ministry of Industry and Information Technology	Notice on Further Implementation of Periodic Deferred Repayment of Principal and Interest on Loans to SMEs	For inclusive SMEs loans, the commercial loans can be postponed, banking financial institutions should provide support with repayment convenience

Source: compiled by the authors.

of 120% to 150%, on April 21, 2020, state council executive meeting decided to SMEs banks set aside coverage regulatory requirements stage by 20%, adjusted to 100% 130%. Without considering the bad loan balance changes, in theory, the biggest one can release 300 billion yuan in loans impairment provision, improve the ability of SMEs bank credit. As it can be seen from the above policies, People's Bank of China and the financial regulatory authorities are committed to helping SMEs banks tide over the epidemic, while improving their ability to support SMEs, so as to achieve the dual goals of ultimately promoting the flow of funds to the real economy and maintaining the stability of the financial system (See *Fig. 2*).

CONCLUSION AND OUTLOOK

COVID-19 has had a severe impact on SMEs and financial markets. As the supporting force of China's economic development, the survival and recovery of SMEs are crucial to the future development of China's economy. To support the development of SMEs and maintain the stability of the financial market, the government has issued a number of financial support policies. Under the influence of various policies of the government and financial regulatory authorities, the macro-economy gradually stabilized, the resumption of work and production of SMEs entered the right track, and the overall stability of the financial market was achieved.[6]

Although the epidemic in China has been effectively brought under control, as the pandemic continues to spread internationally, the downside risks to

[6] China Economic and Financial Research Group, Bank of China Research Institute. In Response to the Severe Impact of COVID-19, Decisive and Drastic Policy Adjustments are Needed-Bank of China Economic and Financial Outlook Report (Q2 2020). *International Finance.* 2020;(4):51–59.

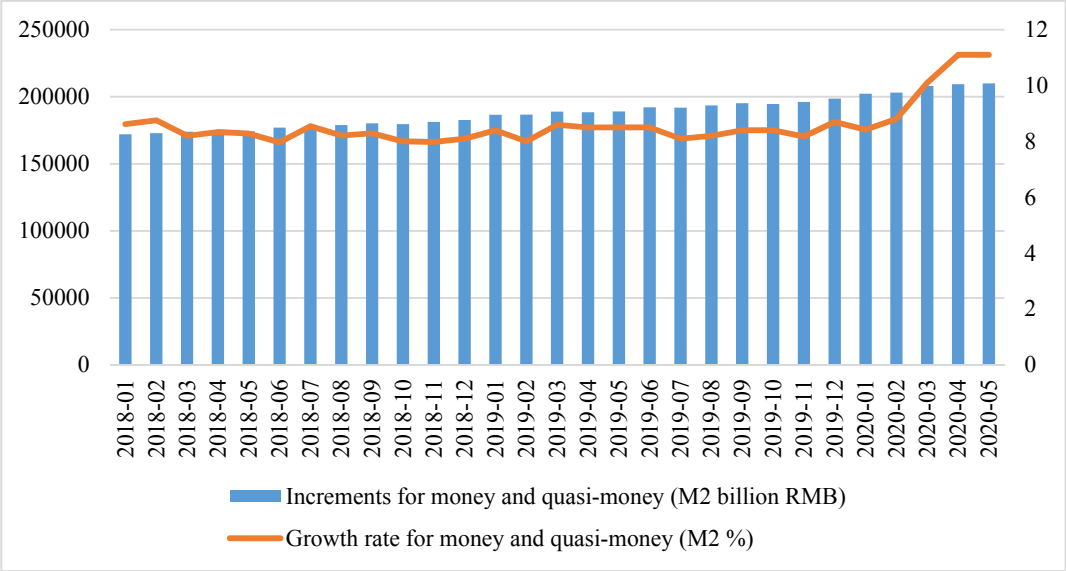

Fig. 2. **Increments and growth rate for money and quasi-money (M2), monthly figures**

Source: compiled by the authors.

the world economy have intensified and destabilizing and uncertain factors have significantly increased. As a result, enterprises will face new difficulties and challenges in resuming work and production as well as economic and social development [16]. Data from the General Administration of Customs showed that in the first quarter of 2020, the total import and export value of China's goods trade was 6.57 trillion yuan, down 6.4 percent compared with the same period last year, among which exports were 3336.3 billion yuan, down 11.4 percent year-on-year. Export is one of the three engines driving China's economic development. The contraction of overseas market demand will cause a new round of impact on foreign trade enterprises and economic development. Since a large proportion of foreign trade enterprises are SMEs, the out-of-control epidemic abroad will make the resumption of work and production of SMEs even worse. At present, the state is supporting the development of SMEs foreign trade enterprises by developing cross-border e-commerce, guiding the transfer of export products to domestic market, expanding diversified international market, and encouraging foreign trade innovation. At the same time, the state is guiding financial institutions to provide financing support and insurance services to try their best to rescue SMEs foreign trade enterprises. However, if the pandemic triggers a sustained global recession, the future course of economic recovery and development will be uncertain.

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The Coronavirus Will Not Change the Long-Term Upward Trend of China's Economic Development

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ABSTRACT

The author investigates the impact of COVID-19 and macro-policy adjustment on China's economic development. The **aim** is to describe the situation and trend of China's economic development before and after COVID-19. The research **method** is the comparative data analysis. The study shows that in response to COVID-19, the Chinese government, on the one hand, has accelerated its opening-up, taken the opportunity of fighting against the pandemic to provide medical assistance to and cooperate with other countries, and actively promoted the building of a community with a shared future for mankind and the process of globalization. On the basis of the Belt and Road Initiative and multilateral, regional, and subregional cooperation mechanisms such as the United Nations, Shanghai Cooperation Organization, BRICS (Brazil, Russia, India, China, South Africa), G20 (Group of 20), and APEC (Asia-Pacific Economic Cooperation), China and the Eurasian Economic Union began to cooperate more frequently and the trade relations between Japan, South Korea, and European developed countries became closer. Meanwhile, committed to building a global interconnection partnership, China actively participates in global economic governance and provides various public products. The Chinese government has proposed "Six Guarantees" on the basis of "Six Stability". In order to achieve the purpose of stabilizing foreign trade and expanding imports, China has imposed various measures to accelerate the liberalization and facilitation of international trade and investment, such as implementing the new version of the "Foreign Investment Law", establishing free trade zones, and promoting its experience and organizing international import expositions. Additionally, the Chinese government also implemented targeted fiscal and monetary policies, increased support for enterprises, especially small and medium-sized enterprises, and promoted the construction of "new infrastructure" and innovation of business model, which have formed the driving forces for the transformation of the economic development model in China from traditional business to cloud business, from traditional marketing to live streaming marketing, from traditional sales to online sales. The author **concluded** that China's adjustment of macro policies in response to COVID-19 was effective and played an important role in the resumption of production and life, stabilizing foreign trade activities, releasing domestic demand and promoting stable and sustained growth of the economy.

Keywords: COVID-19; new infrastructure; business models; stable and sustained growth; reform and opening up; digital economy; cloud business; live streaming marketing; macro-policy

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INTRODUCTION

Since China's economic development entered the "new normal"[1] stage in 2014, although the economic growth rate has slowed, the real GDP growth was still very high, accompanied by more stable economic growth, more diverse growth momentum, more optimal economic structure, and more stable development prospects. In 2020, the outbreak of COVID-19 disrupted this state. This major pandemic has an unprecedented impact on the sustainable development of China and the global economy in terms of extent, depth and breadth. Although the Chinese government quickly took measures to bring the epidemic under control, China's economic development still faces huge challenges and risks in the post-epidemic era due to the normalization of epidemic prevention and control and many uncertainties. Therefore, while strengthening the prevention and control of the epidemic, the Chinese government adjusted the macroeconomic regulation in time and made more pragmatic and meticulous arrangements for economic and social development. A series of reform and opening-up

[1] The characteristics of the new normal economy are that the economic growth rate changes from high speed to medium speed. The economic structure has been constantly upgraded, and the driving force for economic growth has shifted from factors of production and investment to innovation.

measures introduced by the Chinese government is conducive to maintaining the long-term positive trend of economic development.

THE PANDEMIC HAS CAUSED A COMPREHENSIVE AND FAR-REACHING IMPACT ON CHINA'S ECONOMY

One of the severe consequences of the outbreak of the pandemic and its global spread on China's economic development is the deterioration of the external environment and increased uncertainty. First, the logistics obstruction caused by the draconian measures and the shutdown of a large number of enterprises has caused a huge impact on the deeply integrated global industrial chain and close collaboration. Many foreign trade companies have difficulty completing orders because of the shutdown. Europe and the United States, which are upstream of the global value chain, have been greatly affected, especially the high-tech products produced by these two regions. China is in the middle of the value chain and relies heavily on upstream products, which has led to a large negative impact on nearly 40% of its imported products. Second, the prevailing trend of counter-globalization, rising trade protectionism, cratering global economy, increasing unemployment worldwide and the sharply declining income has been precipitating the economic crisis, which caused steep declines in international trade. Third, the conflict between China and the United States has intensified. The United States has stigmatized and politicized China's epidemic, continuously promoted trade wars and technological wars, and even put forward the idea of "disengaging-from-China". Meanwhile, the United States has been constantly instigating conflicts of the affairs of Hong Kong, Taiwan and the South China Sea. All these have negatively affected China-US economic cooperation. These have greatly increased the pressure on China to develop an export-oriented economy, which has created an urgent need for China to seek breakthroughs.

The impact of the epidemic on China's domestic economic growth is direct and serious. During the epidemic, due to the draconian measures such as quarantines and lockdowns, restrictions on the movement of people, and corporate shutdowns, consumer demand has experienced a sharp decline in a short period, which has had a great impact on service industries such as commercial retail, tourism, catering, hotel, entertainment and aviation. Industry, construction, export and investment activities have also been affected to a certain extent. As a result, China's GDP contracted by 6.8 percent in the first quarter of 2020. Specifically, the added value of the primary industry decreased by 3.2 percent, the added value of the secondary industry decreased by 9.6 percent, and the added value of the tertiary industry decreased by 5.2[2] percent. This is the first time China has experienced negative growth since the quarterly GDP data began to be published in 1992. However, the good news is that China has brought the epidemic under control in a short period. As the production of Chinese enterprises begins to resume, the impact of the epidemic on the economy will gradually weaken. China's economy contracted before growing in the first half of 2020. In the second quarter of 2020, GDP increased by 3.2 percent, turning from negative to positive. Total retail sales of consumer goods in May contracted by 2.8 percent year on year, 4.7 percentage points less than that in April, and increased by 9.8 percent year on year in June, 1.2 percentage points higher than the previous month with a 0.96 percent increase.[3] However, due to the continued global spread of coronavirus and economic recession, the need to coordinate the control of the epidemic with normal life, and people's psychology and other factors, it will take a long time for China's economic growth to fully return to the state before the epidemic. The World Economic Outlook report released by the International Monetary Fund in April lowered the forecast of global GDP growth in 2020 from 3.3 percent in January to 3 percent. It is expected that China's GDP will grow by 1.2 percent, and by 2021 it will grow by 9.2 percent.[4] It should be said that this expectation is more optimistic.

[2] National Bureau of Statistics of the People's Republic of China. URL: http://www.stats.gov.cn/ (accessed on 24.09.2020).
[3] National Bureau of Statistics of the People's Republic of China. URL: http://www.stats.gov.cn/ (accessed on 24.09.2020).
[4] I.M.F., IMF World Economic Outlook. URL: http://www.imf.org (accessed on 24.09.2020).

THE LONG-TERM POSITIVE ECONOMIC TREND OF CHINA'S ECONOMY HAS NOT CHANGED

Although the coronavirus has a short-term impact on China's economic growth, it has not changed the trend of China's long-term economic development. The reasons are as follows. First, China's current GDP per capita has exceeded $ 10,000 and the urbanization rate has just reached 60%. In the future, urbanization and metropolitanization will have growth capacity that can continue to provide impetus to economic growth. Second, China has a population of nearly 1.4 billion and a middle-income group of more than 400 million. It is the world's largest single market and the fastest growing market with huge potential. For example, between 2012 and 2018, more than half of the growth in the global luxury goods market came from China. In 2019, Chinese consumers drove 90 percent of the global luxury goods market growth and promoted 35 percent of luxury goods consumption [1, 2]. With the development of the Internet and logistics industry, consumption in rural China and third- and fourth-tier cities has also been stimulated. Although the pandemic and the cratering of the economy significantly affected the export business, as long as the domestic consumer market is fully stimulated, China's economy can be restored through its domestic demand in the short term or in the long run. Third, China has 900 million labor resources, of which 170 million are highly educated and skilled people, and there are more than 8 million university graduates each year. Economic growth is shifting from population-driven to talent-driven. Fourth, China has more than 120 million market participants, which are full of innovation and entrepreneurship. The "mass entrepreneurship and innovation" policy proposed by the Chinese government will further stimulate the enthusiasm and passion of innovation and entrepreneurship in the whole society, and promote the formation of more "new engines" of economic growth. Fifth, China has complete infrastructure, with high-speed railways, highway mileage, and the number of 10,000-ton berths in ports all ranking first in the world. China's industrial system is very sophisticated. It is the only country in the world that has been certified by the United Nations to have a complete industrial system. Internet, artificial intelligence, big data and other technologies that are widely used, will further expand into various fields, continue promoting economic development and innovation after the pandemic and drive e-commerce, e-government, virtual conference/business, online teaching and other new business models into a new round of rapid development. At present, China's traditional industries account for less than 70% of the economy, and the prospects for digital industrialization and industrial digitalization are extremely broad. In 2018, China's total digital economy reached 31.3 trillion yuan, accounting for 34.8 percent of GDP, rising by 1.9 percentage points than that of the same period last year, and its contribution to GDP growth reached 67.9 percent, rising by 12.9 percentage points[5] than that of the same period last year. Sixth, China will further promote Reform and Opening policy, actively participate in international economic coordination and cooperation, and maintain a sound external environment. These are conducive to further creating a more open, standardized and predictable business environment, enhancing China's comprehensive strength in participating in international competition, and forming a new advantage of openness and tolerance.

The Chinese economy still faces many problems. For example, the real economy is still in difficulty, private investment is growing slowly, potential financial risks are high, domestic development is unbalanced and inadequate, reform is arduous, and the international environment is uncertain. However, due to the continuous improvement of the economic structure, huge domestic demand, and constantly rising consumption the Chinese economy is seeking growth potential within itself and accelerating the pace of opening up to the outside world, to hold the bottom line of growth in the face of external shocks [3].

With the initial victory of the national battle against COVID-19, lifting restrictions and activating the economy as soon as possible on the basis of strengthening epidemic prevention and control has become the most important task in the post-COV-

[5] CAICT. White Paper on Data Infrastructure [R]. URL: http://www.cbdio.com/image/site2/20191121/f42853157e261f (accessed on 24.09.2020).

ID-19 era. Faced with unprecedented difficulties and challenges, the Chinese government has put forward the "Six Guarantees" policy (ensures security in jobs, basic living needs, operations of market entities, food and energy security, stable industrial and supply chains, and the normal functioning of primary-level governments) on the basis of "Six Stability" policy (ensures stability in employment, financial operations, foreign trade, foreign investment, domestic investment, and expectations). This is a timely adjustment made by the Chinese government in response to changes in the internal and external environment. At the macro level, the "Six Guarantees" policy did not deviate from the direction of "Six Stability", but made more pragmatic and detailed arrangements. For example, the "Six Stability" and the "Six Guarantees" both give top priority to employment. The goals of ensuring stability in financial operations, foreign trade, foreign investment, domestic investment and expectations in the "Six Stability" are consistent with those of ensuring operations of market entities, stable industrial and supply chains in the "Six Guarantees". The content of "ensuring industrial and supply chains" is aimed at dealing with the risks faced by domestic enterprises. The content of "Ensuring food and energy security" means trying to take precautions. The content of "ensuring the normal functioning of primary-level governments" is the minimum requirement and organizational guarantee for the society to resume as soon as possible. On the whole, "Stability" is the foundation and "Guarantee" is the bottom line. By ensuring "Stability" through "Guarantee" and seeking progress through "Stability", China will be able to overcome temporary difficulties and risks in the long run and lay a solid foundation for economic and social recovery and development [4].

Given the great uncertainties in the pandemic and the economic and trade situation, China has given top priority to ensuring employment and people's livelihood, which does not mean that China will give up economic growth. Instead, China is focusing on the quality of future economic development while addressing current issues and avoiding the negative consequences of past overly loose monetary policy. Economic growth is the foundation for stabilizing employment, ensuring people's livelihood, promoting consumption, and driving the market. In other words, the content of economic growth has been integrated into other economic and social development goals.

INTENSIFYING OPENING UP AND STABILIZING FOREIGN TRADE AND FOREIGN INVESTMENT

Comprehensive and in-depth integration into globalization is an important reason for China's rapid economic development. In the face of the current situation of anti-globalization and prevailing trade protectionism, China will continue to promote all-round opening up and develop an open economy at a higher level. This will not only create necessary conditions for China's high-quality economic development but also promote opening-up and cooperation among countries for common development worldwide.

First, China has stepped up opening-up to promote in-depth market-oriented reform through high-level opening-up. First, in order to further promote and protect investment and encourage more foreign investment in modern agriculture, advanced manufacturing, high-tech and modern service industries, as well as in the central and western and northeast areas, China implemented the new version of the Foreign Investment Law of the People's Republic of China on January 1st, 2020, trying to eliminate restrictions on foreign participation, open up the service sector, especially the financial sector, cancel the foreign ownership restrictions and protect intellectual property rights. Second, in recent years, China has established pilot free trade zones in 18 provinces and cities, giving them greater autonomy in reform and innovation, and spreading their successful experience to the whole country. Based on that, with the focus on promoting the freedom and convenience of trade and investment, the whole island of Hainan will be built into a free trade port, making Hainan a special region. At the same time, Hainan will implement a "zero tariff" system for trade in goods, and trade in services will be open to foreign investors. Third, China has taken other measures, such as holding an international import Expo in Shanghai every year to expand imports and reduce tariff barriers.

In the plan entitled "The CPC Central Committee and the State Council to Promote and Improve the Socialist Market Economic System in the New Era"

adopted on May 11, 2020, the Chinese government further proposed the goal of building a new open economic system of a higher level and promoting reform and development with "opening up". All this shows that, no matter how the international environment may change, China will unswervingly push forward its opening-up policy and make greater efforts to do so.

Second, China has actively promoted the Belt and Road Initiative and cooperation with the Eurasian Economic Union. Since the Belt and Road Initiative was put forward in 2013, China has received response and support from an increasing number of countries. The sudden outbreak of COVID-19 has had a huge impact on the construction of the Belt and Road Initiatives, but it has also encouraged China to adopt a more diversified model of cooperation. For example, as the first country hit by COVID-19 and the first to contain it, China has increased its assistance to countries that cooperate to build the Belt and Road Initiative. This not only provides support "made in China" for the global fight against the epidemic, but also further strengthens cooperation with countries that are critical to the Belt and Road Initiatives, including Russia, Pakistan and Iran. The focus of the Belt and Road Initiatives has also shifted from energy and infrastructure to health care and digital telecommunications. The sanctions imposed by the United States and the Western world on Russia have even brought China and Russia closer to each other on the basis of a solid, traditional relationship. China and Russia have reached agreement on the establishment of the Eurasian economic partnership and agreed to promote cooperation among the Belt and Road Initiatives and the Eurasian Economic Union, and to take advantage of SCO (Shanghai Cooperation Organization) to open up space for common economic development on the entire Eurasian continent [5, 6]. These are not only in line with China's proposal of consultation, contribution and shared benefits of the Belt and Road Initiatives and building a new type of international relations and a community with a shared future for mankind, but also in broad agreement with Russia's proposal of a greater Eurasian partnership in handling the basic principles of international relations and promoting regional economic integration and development. In the near future, Eurasia will become an alternative to western political and economic system which is totally different from western forms of economic development mode and build an economic partnership among ASEAN and the Regional Comprehensive Economic Partnership (RCEP), the Eurasian economic union, the economic cooperation organization and the EU. Meanwhile, these countries and organizations will communicate with each other through the cooperation of the hardware infrastructure of six economic corridors and three blue economic passages.[6] Trade and investment facilitation will be achieved through the cooperation of software infrastructure such as regulations, standards and laws, with the ultimate aim of building a globally oriented free trade area of high standards throughout Eurasia.

Third, China actively promotes the construction of the community with a shared future for mankind, participates in global economic governance and the supply of public products, stimulates the stagnant globalization process. In the first place, China cooperates with the countries suffering from the COVID-19 to carry out medical assistance during the period of fighting the epidemic, and promotes international collaboration with other nations. As of May 31st, 2020, Chinese local governments, enterprises, private organizations, and individuals have donated anti-epidemic materials to more than 150 countries, regions, and international organizations through various channels. At the same time, they also have provided anti-epidemic medical supplies to 82 countries, the World Health Organization and the African Union. China has compiled a complete set of technical documents such as the latest treatment regimen, prevention and control plan, and shared it with 180 countries and more than 10 international and regional organizations in a timely manner.[7] The

[6] The "Six Economic corridors" refers to The China-Mongolia-Russia, new Eurasian Land Bridge, China-Central Asia-West Asia, China-Indochina Peninsula, China-Pakistan and Bangladesh-China-India-Myanmar Economic Corridors. The "Three Blue Economic Passages" refers to the blue economic passage that connects China, the Indian Ocean, Africa and the Mediterranean Sea, the passage that connects China, Oceania and the South Pacific Ocean, and the passage that connects China and Europe via the Arctic Ocean.

[7] The State Council Information Office of the People's Republic of China. Fighting Covid-19, China in Action. June, 2020. URL: http://www.scio.gov.cn/ztk/dtzt/42313/43142/index.htm (accessed on 24.09.2020).

Chinese government promises that the vaccine of coronavirus will be used as a global public product once developed and put into use. Beyond that, China has actively participated in global economic governance and the provision of public products through multilateral, regional, and subregional cooperation mechanisms such as the United Nations, Shanghai Cooperation Organization, BRICS, G20, APEC, etc., building a global interconnection partnership based on the Belt and Road Initiative. At the same time, China has also strengthened trade relations with developed countries such as Japan, South Korea, and Europe, and has included many developing countries in the globalization process. China's increasing economic strength, huge market, and increasingly open and free economy have provided guarantees for participating in global economic governance and the supply of public products and promoting the process of globalization. In fact, China has become a dominant force in building a community with a shared future for mankind and promoting the process of globalization.

China is opening wider to the outside world. By promoting win-win cooperation with all parties, China has stabilized the industrial and supply chains, made its economic development more resilient and potential, and stabilized foreign trade and investment. The effects of these measures start to show and will continue expanding. In the first half of 2020, the actual use of foreign capital in China was 472.18 billion yuan, decreasing by 1.3 percent compared with the same period last year (excluding banking, securities and insurance sectors, as follows). Among them, the second quarter growth is 8.4 percent year-on-year, compared with the 10.8 percent decline in the first quarter, which shows a significant recovery. In June, actual foreign investment reached 117 billion yuan, increasing by 7.1 percent year-on-year, which has shown growth for three consecutive months. Expectations and confidence in foreign investment are stable and growing gradually, and there has been no large-scale withdrawal of foreign investment in China. China's exports and imports fluctuated in the first quarter of 2020, stabilized in the second quarter, and went from negative to positive in June. The value of imports and exports in the first half of the year was 14.24 trillion yuan, decreasing by 3.2 percent year-on-year, with imports and exports falling 3.3 percent and 3 percent respectively, and both of the indicators are better than expected.[8]

STIMULATING DOMESTIC DEMAND WITH NEW INFRASTRUCTURE AND INNOVATIVE BUSINESS MODELS

At present, as one of the Troika, consumption has been the primary driving force of China's economic growth for six consecutive years. In 2019, China's dependence on foreign trade decreased from 65 percent at the historical peak to less than 33 percent, among which the dependence on exports decreased from 35 percent at the historical peak to less than 18 percent, and the contribution of consumption to GDP growth increased to 57.8 percent.[9] The contribution of consumption to economic growth in the first half of 2020 has been raised to 60.1 percent.[10] China has a high savings rate. China's savings rate, which was 50 percent a decade ago, is now 45 percent, still the highest in the world and the potential for investment and consumption is huge. China's economic growth model has begun to shift from exports and investment to domestic consumption. Regardless the perspective of short-term supply and demand balance or medium and long-term economic growth, the importance of boosting consumption for macroeconomic stability and healthy development is far greater than that of stimulating investment. However, the outbreak of COVID-19 has had the biggest impact on consumption and the longest period of negative impact. From January to April in 2020, the total retail sales of consumer goods dropped by 16.2 percent. Therefore, expanding domestic demand is the key to bringing production and people's life back to normal as soon as possible and promoting economic growth.

To stimulate domestic demand, it is necessary to expand public and private consumption. The Chinese government has expanded public consumption mainly through a proactive fiscal policy and a

[8] Ministry of Commerce of the People's Republic of China. URL: http://www.mofcom.gov.cn/ (accessed on 24.09.2020).

[9] National Bureau of Statistics, PRC. URL: http://www.stats.gov.cn/ (accessed on 24.09.2020).

[10] National Bureau of Statistics, PRC. URL: http://www.stats.gov.cn/ (accessed on 24.09.2020).

prudent, flexible and appropriate monetary policy, combining short-term stimulus with long-term planning. According to the Government Work Report of the State Council for 2020, the deficit-to-GDP ratio will rise from 2.8 percent last year to more than 3.6 percent in 2020, with a deficit of 3.76 trillion yuan and the issuance of 1 trillion yuan of special government bonds to combat the pandemic. This is the first time China's fiscal deficit has exceeded 3 percent, the highest on record. These fiscal expenditures are mainly used for upgrading old cities and urban renewal, improving public service facilities such as medical care and education, and improving the environment, and providing cash or consumption vouchers to low-income and unemployed people to ensure their basic living expenses. The Chinese government has also reduced the operating risks of small and medium-sized enterprises and stabilized the income and employment of residents by reducing taxes and fees and fiscal subsidies, in conjunction with monetary policies such as interest rate cuts, targeted RRR cuts and interest rates on re-loans and excess reserves cuts.

Building new infrastructure will not only stimulate investment demand but also provide important support for China's economic and social prosperity in the future. The old infrastructure projects, mainly railways, highways, airports, ports and water conservancy facilities, are characterized by large investment scale, long construction cycle, obvious short-term stimulus effect and slow return on investment. Relatively speaking, new infrastructure projects focus on new technologies, which emphasize stable growth and employment rather than strong stimulus, and focus on "use" rather than "construction". Their purpose is to promote the development of new forms of business, new industries and new services through informatization, intelligentization and digitization.[11] As a result, new infrastructure can not only rapidly expand investment demand, stimulate the economy and create more jobs in the short term but also become the most important engine of high-quality economic development, unleash economic growth potential and enhance international competitiveness. They will contribute a lot to improving production and consumption conditions, enhancing the efficiency of transportation, information exchange and business cooperation, and promoting the development of new industries and fields.

To stimulate domestic demand, China relies mainly on business model innovation rather than on cash and consumer vouchers. The innovation of the business model can not only stimulate consumption in the short term but also form a long-term mechanism to promote consumption growth, making it a new engine to lead consumption, promote industrial structure upgrading and boost economic growth.

In addition to income, consumption is also affected by psychology, willingness, scene, convenience, and other factors. Although people have a strong tendency to consume explosively after the epidemic, it is not feasible to start offline consumption on a large scale in the short term due to the risk of personal health and the need of social epidemic prevention and control. To this end, efforts can be made on the supply side to promote the innovation of business models of brick-and-mortar stores, so as to realize as soon as possible the transformation from traditional business to cloud business, traditional marketing to live streaming marketing, independent development to shared platforms, indoor sales to outdoor sales [7–9].

The transformation from traditional business to cloud business is to shift from offline sales to the combination of online and offline sales, so as to realize the deep integration of digital upgrading of goods, transactions, data and services with online and offline sales. For example, stimulating consumption through online sales, TV sales, online discounts and promotions, online shopping festivals; conveying relevant information through the live broadcast of museums, art galleries and amusement parks and attracting people through livestream culinary classes, etc. These measures, together with the issuance of consumption subsidies and discount vouchers, can effectively promote the release of consumption potential. Pinduodo (NASDAQ: PDD) has seen an average of 65 million packages in transit per day since May, increased by 30 percent from March, according to the company's 2020 Q1 financial report. Shanghai has also launched the "May 5th Shopping Festival &

[11] State Council of the People's Republic of China. Opinions on Accelerating the Improvement of the Socialist Market Economy in the New Era. *People's Daily.* 19.05.2020(06).

Quality Life and Live Week" to prepare itself as "the most live-streamed city". Pinduoduo spent $ 2.5 billion on consumer subsidies during the campaign. In addition, many foreign trade enterprises have turned to live broadcasting for domestic sales, which has also achieved good results. The 127th China Import and Export Fair, which opened on June 15, was also put on the "cloud" for the first time for live broadcast sales, breaking the original time and space boundaries and ended up attracting a large number of customers.

The transformation from traditional marketing to live streaming marketing aims to promote consumption by non-sales people, including online celebrity promotion, the offline launch of a small discount of brand-name products and best-selling products to attract customers and drive sales of other products, as well as online and offline demonstration consumption by government officials, celebrities and ordinary people. The live streaming of mayors is very popular across the country. For example, data released by Pinduoduo shows that until May 14th, Pinduoduo has been more than 425 million kilograms of agricultural products sold in its "Mayors' livestreaming rooms", and 113,000 new enterprises aiming to "shift from foreign trade to domestic sales", with the turnover exceeding 5.89 billion yuan. Dong Mingzhu, Chairwoman of Gree Electric Appliances, started live streaming with 30,000 offline stores, and explored the new retail form of three key links: online traffic, offline stores and supply chain.

The transformation from independent development to shared platforms means that previously independent production and operation enterprises, especially small and medium-sized enterprises and individual producers and operators, take the initiative to integrate into the ecosystem of shared platform, take advantage of their own strengths and resources to carry out collaborative operations, and provide unique and convenient products and services to consumers. "Shared employees" in various e-commerce platforms and catering enterprises, as well as Sinopec's vegetable and coffee businesses are typical examples of this model.

The transformation from indoor sales to outdoor sales means improving and expanding the places where goods and services are consumed, and standardizing the development of the stallholder economy, roadside catering, outdoor entertainment, and night economy. These business entities can promote the recovery of market sentiment, increase employment, and stimulate consumption on the premise of no large-scale group consumption behavior. The reason lies in that these commercial entities meet the needs of consumers, facilitate their purchase and make them prone to random or impulsive consumption. In the past, most of these commercial activities were prohibited because of their negative impact on the appearance of the city, damage to environmental sanitation, violation of fair competition, occupation of public resources such as roads, lack of permits, tax evasion and other reasons. Now, the development of the street economy and the small shop economy start to be encouraged across the country. Shanghai launched the first Shanghai Nightlife Festival on June 6th, featuring more than 180 activities including Shanghai Bar Festival, late-night dining Festival, late-night entertainment, late-night show, and late-night reading.

China has a large population, low labor cost, high Internet penetration, developed logistics, convenient delivery and the world's best online shopping infrastructure. Even in remote villages, mobile networks and logistics are well spread. These provide good conditions for business model innovation. China has a wide range of commodities at cheap prices. The innovation of the business model can become a new carrier and engine to lead consumption, promote industrial structure upgrading, and drive economic growth. Thanks to the innovation of the above business model, China's online consumption showed a good development trend during and after the epidemic. China's express delivery volume and revenue reached 7.38 billion yuan and 77.1 billion yuan in May, increased by 41 percent and 25 percent year on year, respectively, hitting new peaks since February 2018, according to data released by the National Bureau of Statistics of China.[12]

CONCLUSION

From the international environment perspective, in the post-COVID-19 era, the center of gravity of the world economy will continue to shift eastward to

[12] National Bureau of Statistics, PRC. URL: http://www.stats.gov.cn/ (accessed on 24.09.2020).

Asia, and multipolar cooperation will become a new trend in economic globalization. Meanwhile, the Fourth Industrial Revolution, marked by big data, artificial intelligence and digitalization, will become a new engine of economic growth. All this has created conditions for the recovery and development of the global economy and China's economy in particular.

Due to reform and opening-up, China has now escaped the middle-income trap. With the sound foundation of China's economic development, the government can timely adjust its macro policies in accordance with changes in the domestic and international environment. Policy adjustments are highly flexible and the economy is resilient. Despite the huge impact of COVID-19 on the sustainable development of China's economy and the uncertainty of the external environment, China has taken strong and effective measures to cope with the epidemic and economic downturn and has become the first economy in the world to emerge from the epidemic and gradually return to normal operations. At the same time, the Chinese government has introduced a series of economic stimulus policies and measures aimed at restoring production and livelihood, stabilizing foreign trade, and stimulating domestic demand. These measures have produced good results and provided new support for China's economic stability and sustainable development. The emergency of COVID-19 and "anti-globalization" has not changed the general trend of China's economic and social development from rapid growth to high-quality development. On the contrary, it has provided China with valuable opportunities for a broader opening to the outside world and pursuing innovative development. All these factors will give a strong impetus to China's economic development and ensure its stable and sustained development.

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REVIEW

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Efficiency of the Funded Elements of the Pension System: International Practices

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ABSTRACT

The author summarizes key science theories of the funded pension system and its development. The **aim** of the article is to review and discuss the studies on the efficiency of the funded elements of the pension system from the perspective of international practices. The research **methods** included generalization; classification and comparative analysis of theoretical and methodological approaches to evaluating the efficiency of a pension system and its elements; abstraction, which allowed us to classify existing pension plans on the basis of the materials presented in the paper; as well as scientific and grouping methods. The theoretical background of the research is based on the scientific studies indexed in Scopus, Web of Science and RSCI (Russian science citation index) for the period 1981–2019. To organize the presented data this period was divided into four stages depending on the role of the funded elements in the public pension system of the reviewed countries. The **results** of the research are the systematization and classification of the studies under consideration. Cross-country analysis according to the selected criteria showed that distributive pension systems generally demonstrate a higher level of sustainability and efficiency, as well as are better at ensuring a decent standard of living for the population. The author **concludes** that in order to increase the efficiency of funded elements it is necessary to reduce their influence on the national economic stability; develop additional regulations for pension investment schemes; implement macroeconomic reforms aimed at the development of funded elements, which require a sustainable national capital market. The **conclusions and results** of the paper can be useful for further development of the Russian funded pension system and analytical work of the public and research organizations.

Keywords: pension system; non-state pension fund; pension security; efficiency; pension savings

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INTRODUCTION

Russia, as many other countries, is going through the next phase of pension reforms. Concerning mainly the pay-as-you-go elements (raising the retirement age, changing the requirements for the minimum insurance period, changing the procedure for indexing pension payments), a number of areas are associated with the funded elements of pension provision. This trend is global as of the end of the last decade, more than 70 countries have undertaken some reform in the pension sector. This circumstance indicates the existence of problems associated with pension provision, the insufficient degree of performance of the functions of the national pension systems, and the need for additional scientific and methodological substantiation of the transformation of various elements of pension insurance.

The aim of this research is to review and discuss the results of studies on assessing the efficiency of the funded elements of the pension system in the context of international practices.

The aim has defined the objectives of the study:

- systematize and divide studies devoted to the efficiency of the funded elements of the pension systems by time periods in the context of international practices;
- review and highlight general criteria for the efficiency of the funded elements of the pension systems;
- highlight the features of various stages of research on the efficiency of the funded elements in the context of international practices;
- identify ways to develop and improve the efficiency of the funded elements of the pension system.

These objectives determined the sequence of the study and its stages.

At the first stage we set the boundaries of the study and selected the practices of countries in the implementation and use of the funded elements of pension provision, as well as the authors of the review.

The second stage included the systematization and identification of four time periods in the study of the funded elements of the pension insurance based on international experience.

At the third stage of the study, we reviewed the analytical and authors' approaches to assessing the efficiency of the funded elements of the pension provision and identified efficiency criteria that are universal for all countries. We compared the efficiency levels of the pay-as-you-go and funded elements across countries based on the actual date.

Then the features of the stages of research on the efficiency of funded elements in the context of international experience were characterized, universal methods and results of this subject area were generalized, alternative options for the development of the funded elements were identified. The author highlighted the periods of popularization of this area of research among domestic and foreign scientists (both at the national and international levels).

Despite the popularity of research on the funded elements of the pension system among domestic and foreign economists over the past four years (E. Tarando, J. Wang (2019) [1], E. Gurvich, (2019, 2018) [2, 3], M.A. Ivanova (2018) [3], I. Madero-Cabib (2019) [4], I. Reutova (2018) [5], M. Amman, C. Ehman (2017) [6], D. Himik, S. Audousset-Coulier (2016) [7] et al), there is little agreement on the role of the funded elements among researchers, as well as their impact on the stability of the national economy. This is largely determined by various factors of the global and national economy. These differences are best traced in studies of different periods. Within the framework of our research, we distinguish four periods (*Table 1*).

Pension reform has always been on the agenda throughout the entire period of the pension system development [8, 9]. In ad-

dition to fundamental works, many analytical reviews are devoted to the study of the funded elements and their efficiency.[1]

METHODOLOGY AND DATA SOURCES

This work is a review of studies on the assessment of the functioning of the funded elements of national pension systems from the point of view of international experience. We were guided by the following criteria when choosing a base study of the article:

1) similar research problems setting;

2) a description of the funded elements phase-in in different countries or the empirical nature of the study;

3) identification of factors and indicators of efficiency directly related to the funded elements of pension provision;

4) analysis of the introduction of the funded elements into the pension systems of countries, taking into account the following characteristics:

- introduction of the funded elements within the compulsory pension insurance;
- possibility of classifying and grouping according to features that allow assessing the efficiency of the use of the funded elements in the countries (the relative size of the pension provision, the level of coverage of the population with various types of pension programs, the expenditure on pensions as a percent of GDP);

5) keywords of the research.

Additionally, we considered the following scientometric indicators when choosing the works of a particular author:

1) the h-index of the researcher, as well as the citation index of his works on the funded elements of pension insurance (both at international and national levels);

2) researcher's specialist area on the problems of pension insurance, social security, pension savings investment in various countries.

A new approach has been developed and applied to generalize the results of the analysis of the funded elements, which includes universal efficiency criteria for all countries. This approach helps to predict the development trends of the funded elements in different countries.

Summarizing the global experience of the pension systems functioning, the following types of the funded elements can be distinguished.[2]

1) as an independent level within the multi-level system of compulsory pension insurance;

2) as an additional component in the form of a non-state pension system;

3) in the form of professional pension systems existing both at the state level and at the level of individual enterprises and industries;

4) by privatization of the pension system.

Most of these programs are based on funding principles. However, in some countries (France, Germany, Japan), corporate pension programs are based on pay-as-you-go principles [14, 17–20].[3]

Regardless of the nature of the elements, they are assigned the following tasks:

1) achieving the required level of pension provision for citizens;

2) maintaining the financial stability of the pension system.

The choice of a certain type of pension coverage, the relationship between them, and therefore the nature of the elements depends

[1] See, for instance, OECD (2017): Pensions at a Glance 2017: OECD and G20 Indicators, OECD Publishing, 2017, Pension markets in focus. OECD, Private Pension Unit and Pension Statistics Group. November, 2013–2019. URL: https://www.oecd-ilibrary.org/social-issues-migration-health/pensions-at-a-glance-2017_pension_glance-2017-en; https://www.oecd.org/pensions/private-pensions/pensionmarketsinfocus.htm (accessed on 13.08.2020).

[2] Compiled by [1, 3, 18–21].

[3] Averting the old-age crisis: Policies to protect the old and promote growth. Washington, DC: The World Bank; 1994. p. 436. URL: http://documents1.worldbank.org/curated/en/973571468174557899/pdf/multi-page.pdf (accessed on 25.12.2019).

Table 1

Stages of development and research of the funded elements of the pension insurance

Stages	Period	Stage description
Stage I	Until 1980	Funded elements are private, voluntary
Stage II	1980s — mid 1990s	The emergence and spread of the funded elements in mandatory pension systems. Integration of the funded elements into the mandatory pension system
Stage III	Mid 1990s-2012	Issues with the stability of the funded elements. Search for the optimal ratio of the pay-as-you-go and funded elements within the framework of multilevel models
Stage IV	2013–2020	The present stage, characterized by new development trends of the funded elements of the pension system

Source: compiled by the author.

on the degree of fulfillment of the above tasks. It can be concluded that this is a practical manifestation of the level of **efficiency** of the pension system.

OVERVIEW OF APPROACHES TO ASSESSING THE EFFICIENCY OF THE FUNDED ELEMENTS

In addition to scientific research, practical reviews are also devoted to the efficiency criteria of various elements of the pension system.

The Monash Center for Financial Studies provides an integrated assessment of the efficiency of the funded elements of the pension system. This approach is based on the results of the pension policies implemented in different countries. The global pension index includes three values: adequacy (40% of the final index value), sustainability (35%), integrity (25%).

As a result of assessing the efficiency of pension systems in various countries, the authors of this report come to the conclusion that systems with predominantly pay-as-you-go elements are more efficient (the Netherlands, Denmark, and Australia). The most efficient pension systems with predominantly funded elements are those of Chile and Singapore. Thus, according to the authors, the presence of the funded elements in the structure of the pension system in itself is not an issue or a factor of instability.

We consider other reports and research devoted to the study of the funded elements in world practices to prove or refute this conclusion.

The list of indicators for assessing the efficiency of the funded elements of the world pension systems presented in the OECD reports has been stable over a long

period of time and includes the following indicators:

1) total assets of private pension funds;

2) the share of the funded elements in the total amount of pension coverage;

3) net profitability of pension savings;

4) allocation of pension savings across various categories of assets, etc.

Based on the above, it can be concluded that the reports on the efficiency of the funded elements in foreign countries are complex and the results of the development of pension systems can be compared in the context of achieving the specified efficiency indicators.

The **efficiency** of the funded elements of the pension system is considered a controversial topic in scientific studies. According to T.V. Gapeeva [18, p. 19], efficiency of the funded elements of the pension system is determined by as follows:

1. A close relationship between individual contributions and retirement benefits.

2. Increased profitability, since the sum of collected contributions is not immediately used to pay the pension but is invested.

3. Obtaining additional financial resources for the development of the economy through the above investment mechanism.

4. Assessment of contributions in advance, as a set contribution scheme is used.

5. Benefits reflect pension funds accumulated by the time of retirement.

Thus, the author concludes that the efficiency of the funded element of the pension system is determined by the peculiarities of its functioning and its development. In this regard, the importance of comparing international experience in the institutional development of pension systems (including the use of the funded elements in their structure) increases.

The efficiency criteria of the funded pension system are largely based on its **function**. This point of view is supported by V.D. Roik [19].

It can be concluded that the ideas of T.V. Gapeeva and V.D. Roik are similar since they propose to use the institutional characteristics of the world's pension systems as a basis for assessing efficiency.

A different opinion on the efficiency criteria of the pension system is given by A. Gudkov [20]. In his research, the author shows that the efficiency of the pension system is achieved in the case of "maintaining a balance of interests of contributors and pension recipients". Thus, we can trace the use of quantitative indicators for analyzing the efficiency of the funded elements of the pension system. In our opinion, the universality of this criterion makes it possible to apply this approach to pension systems in different countries.

The approach of D.V. Mel'nik and M.I. Miryakov [11, p. 44–48], who analyzed the funded elements on the example of the country that first introduced them at the mandatory level — Chile. The authors consider the efficiency of the funded elements through the influence on economic development in the country and the economic growth rate.

According to A.V. Pudovkin [21], efficiency indicators of the funded elements include:

1. The balance level of the pension system as a whole.

2. Investment results of pension savings (the author recommends calculating this indicator using the weighted average accumulated return indicator).

The approach presented in the works of foreign authors can also be attributed to a certain criterion of the efficiency of the funded elements of the pension system. [22]. In their opinion, to determine the feasibility of using funded elements, an assessment of the following indicators is required:

1. The ratio of assets of non-state pension funds to GDP.

2. The ratio of accumulated pension reserves to GDP.

As a result of the cross-country analysis according to the first criterion, it was

Table 2

Replacement rate value for countries with different types of pension system (2018)

Countries with mainly pay-as-you-go pension elements	Replacement coefficient value, %	Countries with mainly funded pension elements	Replacement coefficient value, %
United Kingdom	28.4	South Africa	18.5
Japan	36.8	Mexico	28.6
Switzerland	44.3	Lithuania	31.0
Germany	51.9	Poland	35.1
Sweden	53.4	Chile	37.3
Russia	57.0	Estonia	53.1
France	73.6	Indonesia	59.0
Denmark	70.9	China	79.4
The Netherlands	80.2	Hungary	84.3

Source: compiled by the author Pension markets in focus. OECD, Private Pension Unit and Pension Statistics Group. November, 2013–2019. URL: https://www.oecd.org/pensions/private-pensions/pensionmarketsinfocus.htm (accessed on 13.08.2020).

found that the highest ratio of assets of private pension funds to GDP is observed in Denmark (199% to GDP), the Netherlands (174%), Iceland (161%).%), Canada (155%), and Switzerland (143%).[4] Thus, despite the debt crisis in the euro region and the consequences of the global financial crisis, there has been a significant increase in the assets of pension funds.

Another group of foreign authors presents a slightly different view on the indicators of the efficiently functioning funded pension system [23]:

1. The level of contributions to the funded pension system corresponding to the level of the worker' income.

2. The returns on investing in pension savings.

3. The total private pension funds expenditures in comparison with the returns on the investment of funds.

P. Holzmann and P. Hinz (2005) proposed to evaluate the efficiency of the funded elements according to the following qualitative parameters: adequacy, availability, stability, and reliability [25].

An interesting approach to the parameters of the pension system efficiency was proposed by E. T. Gurvich. According to this researcher, "the basic requirements for the parameters and mechanisms of the pension system are usually grouped into four categories:

1) if possible, pension rights for the dependent population;

2) socially acceptable level of pension benefits;

3) adequate economic burden of financing pension benefits;

4) financial stability of the pension system [2].

The above approach generally corresponds to foreign ideas about the efficiency of the pension system, which include criteria such as population coverage, administrative costs, development of financial and other related market segments, the impact of the pension reform on savings, the redistributive effect of the funded elements of the pension system [11].

These requirements can equally apply to both pay-as-you-go and cumulative funding. In our opinion, when analyzing their implementation for the latter, incomplete compliance should be taken into account, especially in the case of those countries that followed the path of privatizing the national pension system.

Based on the indicated requirements, we highlight *research hypotheses*, on the basis of which it will be possible to determine the current level of efficiency of the pay-as-you-go and funded elements of the pension system, respectively:

1. The greatest coverage is observed in countries with pay-as-you-go financing.

2. The replacement rate does not depend on the type of the pension system.

3. The ratio of pension payments to GDP is higher in countries with a pay-as-you-go pension model.

Thus, when considering the first parameter — pension provision — in Chile, it can be found that the coverage of the economically active population with pensions remained at the pre-reform level — 60%.[5] This circumstance can be explained by the peculiarities of the labor market, as well as trust in the financial market as a whole.

For Bolivia, El Salvador, and Peru, this value is much lower at 10–15% [24]. At the same time, in countries with a dominant pay-as-you-go model, this indicator averages 95%. However, there are exceptions: for example, for Vietnam's pension system,

[4] OECD (2017): Pensions at a Glance 2017: OECD and G20 Indicators, OECD Publishing, 2017. URL: https://www.oecd-ilibrary.org/social-issues-migration-health/pensions-at-a-glance-2017_pension_glance-2017-en (accessed on 13.08.2020).

[5] Averting the old-age crisis: Policies to protect the old and promote growth. Washington, DC: The World Bank; 1994. p. 436. URL: http://documents1.worldbank.org/curated/en/973571468174557899/pdf/multi-page.pdf (accessed on 25.12.2019).

which is exclusively pay-as-you-go, at the end of 2014 this value is 19.4% [9].

Thus, the first hypothesis is confirmed regarding the greater efficiency of the pay-as-you-go element according to this criterion.

The size of the pension is largely characterized by such a parameter as the replacement rate. We consider the value of this indicator for countries with dominant pay-as-you-go and funded elements, respectively (*Table 2*).

As you can see from the *Table. 2*, the highest replacement rate is observed in Hungary, a country with a mainly funded financing model. At the same time, the lowest replacement rate is observed in a country with a mainly funded model (South Africa — 18.5%). A more representative measure of this performance parameter is the average replacement rate. For countries with a dominant pay-as-you-go model, it is 55.17%, and for countries with a predominantly funded model, it is 47.37%, respectively. Based on this, we can conclude that the pay-as-you-go elements are relatively more efficient in this parameter.

Key indicators of the funding burden of pension benefits include the total amount of pension benefits expressed as a percentage of GDP and the effective rate of pension contribution. As a result of our research, we found that currently the countries with the largest share of pension spending in GDP are Italy (16.3%), France (13.8%), Japan (10.2%) (mainly pay-as-you-go elements). The countries with the lowest spending on pensions are Indonesia (0.8% of GDP), India (1.0%), South Africa (2.2%). When considering the value of insurance premiums for pensions, we found that there is no significant relationship between the two parameters mentioned above, since high spending on pensions in relation to GDP does not always correspond to a high insurance burden. Thus, we can conclude that there is no general trend in this parameter for each of the groups of countries identified in this study.

When considering the share of pension spending in total public spending on social services, we found that countries such as Italy and Greece (mainly pay-as-you-go elements) are the highest (over 50%) and lowest in Ireland, USA, and Canada. (less than 20%) [25], which also confirms the above research hypothesis.

Thus, as a result of the generalization and systematization of scientific approaches to the study of the efficiency of the funded elements of the pension system, we can conclude that the most common criteria of efficiency are the level of costs for maintaining the functioning of the pension systems, the return on pension savings investment, the impact on the level of economic development of the country and the rate of economic growth due to the additional financial resources.

We consider which development factors of the funded elements could have an impact on the efficiency of its functioning at various stages.

RESEARCH STAGES: INTERNATIONAL OVERVIEW

First stage

As I. Tepper (1981) noted, "as a result of significant economic growth in the postwar period, pension plans have become an essential component of the financial structure" [26]. Thus, in our opinion, on the whole, the first period of development of the funded elements can be characterized as dynamic. This assumption can be confirmed by the main works of that time [27–29].

In our opinion, this is largely due to the active development of the methodological conceptual base and the development of pension policy regulation. Basically, the process of investing pension savings was considered within the framework of the concept of "ideal markets" [27]. At the same time, also during this period, there are con-

ceptual works devoted to justifying the need to introduce the funded elements at the state level [30].

A number of works of the first stage are also devoted to the taxation of income received from the investment of pension savings [26, 31]. As shown in the above works, the main sources of tax savings are exemption from personal income tax, the investment income received, on the one hand, and on the other, due to the possibility of taking into account employers' contributions when calculating income tax. A number of authors, for example, M. Miller, show that there are no tax benefits when using corporate pension programs [32].

Another area of research of works of that time is the formation of an optimal investment portfolio of pension savings in terms of distribution between stocks and bonds [26, 32]. It should be noted that this direction has not lost its relevance at subsequent stages, and also has become one of the most important in the regulation of pension savings since the proportions of distribution between financial assets affect the level of efficiency of the funded elements in general.

Thus, the possible reasons for the instability of the funded elements in the first stage are not considered separately.

The beginning of the *second stage* of the study can be considered the moment of introduction of the funded elements of the pension system at the state level — May 1981 in Chile [33]. It should be noted that the first attempt to introduce these elements was undertaken almost a hundred years before that: in 1889 in Germany, but a new type of pension reform showed low efficiency [18]. Thus, the experience of Germany at the end of the nineteenth century demonstrated the ineffectiveness of the existence of a funded system in its pure form, which existed since the founding of German pension insurance.

It can be concluded that in many respects the architecture of the new pension reform in 1981 was built on the principles of nationalizing the pension system, which was reflected in the Washington Consensus [15]. During this period, the funded element of pension insurance was introduced as a mandatory element in the following countries: Peru, Argentina, and Colombia (1993), Uruguay (1995).

Pension reforms in these countries led not only to a change in the institutional structure of pension provision but also to the development of the financial market and the achievement of certain parameters of economic growth.

Despite the spread of the funded elements within the framework of compulsory pension insurance, a number of authors of that time continued to emphasize the importance of the state in solving the problems of pension protection of the population. In particular, Z. Bodie (1990) notes that "... the government plays a critical role in the retirement income system –– as provider, insurer, and regulator. Even in the United States, where the private sector is the major source of retirement income..." [34].

Within the framework of the second stage, works devoted to the study of the funded corporate pension programs and their comparison with similar elements of compulsory pension insurance are of great importance. Thus, the significance of the pension savings market for the national economy is noted [35]. In particular, there is a positive impact on the financial instruments market of those countries where such funded elements are used [34]. At the same time, the authors note that only the elements based on the principles of funding have a positive effect on the national economy: in those countries where the pay-as-you-go principles underlie corporate pension programs, this effect is not observed [14].

It should be noted that predominantly funded pension systems within the framework of compulsory pension insurance are

introduced in Latin America, while corporate pension programs are mainly represented in European countries. At the same time, in the Anglo-Saxon countries, the latter is mainly built on funded principles, and in the Romanesque countries –– on pay-as-you-go principles.

We found that the benefits of the funded elements in research at the time included lower tax burdens [36].

We also found that, in contrast to the extremely positive works of the first stage, the factors of the instability of the pension savings market, in particular volatility and tight financial regulation [37], also receive detailed consideration. In the course of research of that time, the authors come to conclusions about the relatively low efficiency of dominant investment in stocks, which is fundamentally different from the conclusion of the work of the previous stage[6] [38].

There are also studies with other results. For example, Friedman (1983) finds that there is no significant relationship between cost in defined contribution and benefit plans [39]. Z. Bodie (1990) confirms these conclusions [40]. Within the framework of this stage, on investment issues, a line of research is being developed on the relationship between the life cycle of a person and a household and decisions made on pension savings and investments [41].

Despite the fact that in the works of this time, both the issues of investment and the introduction of the funded elements at the mandatory state level were quite actively considered, some issues did not receive proper development. This might further affect both the process of introducing these elements into the pension systems of a number of countries and an increase in their level of vulnerability and sustainability, which would negatively affect their efficiency.

[6] Greenwich Research Associates. Report on large corporate pension plans. 1988.

Within the *third stage*, a significant number of works are devoted to the study of the experience of international pension reforms and the analysis of the institutional characteristics of various pension models [42]. The macroeconomic characteristic of this stage can be considered the fact that the world economy of that period was faced with the problem of low growth rates, which actualized research aimed at developing mechanisms to prevent the negative consequences of this recession. One of these levers was retirement savings [21].

Since at this stage quite a few of the world's pension systems were faced with a crisis and have demonstrated the instability of the funded elements, studies devoted to the choice of the optimal forms of pension protection appeared, as well as efficiency criteria of the public and private pension institutions [43–46].

In our opinion, the instability of the funded elements of the pension system also led to works devoted to the regulation of investment mechanisms within the funded elements and comparing funded elements with pay-as-you-go ones [23].

As part of this stage, studies of the results of using funded elements in compulsory pension systems appeared in countries that began privatization-type pension transformations in the early 1980s. Thus, D. Callund (1999) not only conducted a detailed analysis of the institutional and evolutionary characteristics of the Chilean pension model but also identified two problems that subsequently became factors of the instability of this type of pension systems: high costs of managing pension savings, low motivational attitudes of the insured for participation in the funded pension programs [8]. We believe this point of view is reasonable since the world experience of the functioning of pension systems with the funded elements indicates a decrease in the efficiency of such elements due to these factors.

During this time, the funded element of pension insurance was introduced as a mandatory element in the following countries: Latvia, Bolivia, Mexico, and El Salvador (1996), Hungary (1998), Kazakhstan (1998), Poland (1999), Russia. (2001), Costa Rica (2001), Dominican Republic, Lithuania (2003), Ecuador, and Nicaragua (2004) [43, 44]. In many respects, the pension reforms of that time, aimed at introducing a funded element, were carried out on the recommendations of the World Bank.

Thus, we can conclude that the experience of the Chilean pension reform in 1981 became a new conceptual model for the formation and organization of the funded elements within the framework of national pension systems. The analysis of this experience is considered in sufficient detail by R. Holzmann (2005) [24]. We note that if, within the framework of the second stage, the funded elements were introduced exclusively in the countries of South America, then within the framework of the third stage, the geography of countries was significantly expanded. In our opinion, this circumstance may be due to the following reasons:

1) higher post-retirement living standards that were not always achieved through pay-as-you-go pension systems;

2) global thinking –– in modern conditions, the international orientation of residents of advanced economies increased;

3) achievement of privatization pension reforms of the previous stage in the field of improving the living standards of the population, ensuring economic growth and stability of the national economy;

4) the growing relationship between the economies of different countries;

5) the reduced role of government intervention in the economy of most countries and the transition from a state-run economy to a market one in a number of them;

6) active development of the international capital market.

In turn, these consequences were most clearly manifested at the final, *fourth stage* of the distinguished periodization.

The research on the experience of China on the introduction of the funded elements in the pension system should be considered separately [48].

A number of researchers within this stage determined the efficiency of the funded elements in comparison with pay-as-you-go ones [9]. At the same time, the impact on the macroeconomic situation was highlighted as the main advantage, since with a developed level of the funded elements through the investment of pension savings, the economy received additional financial resources for development. Another group of studies of this period is devoted to the issue of investing pension savings [49].

It should be noted that the work of the fourth stage was rather strongly influenced by the consequences of the global financial crisis, which revealed the financial insolvency and vulnerability of the funded elements in a number of world pension systems. The relevance of research in this area is important in modern conditions of economic instability when pension savings become its guarantee [24, 25].

The negative impact of the crisis on global pension systems is also highlighted in the report "Pension Markets in Focus" by the Organization for Economic Cooperation and Development (OECD). Low profitability, low-interest rates, and low economic growth are highlighted as negative factors. We consider this point of view reasonable since the world experience of the functioning of pension systems with funded elements indicates a decrease in the efficiency of such elements due to these factors.

On the other hand, it also led to the emergence of cross-country studies aimed at finding the best options for investing pension savings [25, 51–65].

The main factor of the instability of pension systems highlighted in these studies is

associated with the aging of the population. Among other factors of the need for pension reforms, the increasing level of fiscal burden is distinguished [61]. However, most of the conclusions indicate the need to improve the pay-as-you-go elements and reduce the dominance of the funded ones.

In our opinion, the factor of low stability of the funded elements at this stage led to the emergence of studies devoted to the choice of the most optimal forms of organizing pension savings. According to the authors of the "Pension Markets in Focus" report, defined contribution systems are more resilient to the dynamics of macroeconomic factors.[7]

These studies focus on assessing the impact of the development of the stock market and the directions of the pension reform, as well as the gender and age structure of the population [61]. The development and direction associated with the assessment of the ongoing reforms in the pension sector at the level of economic growth [65]. Some studies assess the impact of pension transformations on labor productivity [62]. The influence of the institutional structure of pension provision on the labor market and the dynamics of interest rates in the financial market [61], as well as the state of the public debt market [25].

Note that if research at the beginning of this stage is more focused on the development of the funded elements and the search for ways to reduce state participation in the pension provision of the population [25], then later works (2017–2019) will focus on improving the pay-as-you-go elements or the pension system generally [53].

It should be noted that the processes of curtailing and reducing the dominance of the funded pension elements at this stage are more typical for European countries and Latin America. In several Asian countries, on the contrary, reforms are currently being implemented to introduce these elements into national pension systems [66, 67] — in particular, in China, Indonesia, South Korea, Malaysia, the Philippines, Singapore, and Vietnam. In our opinion, this feature can be explained by the insufficient level of coverage of the population with instruments of pension protection in these countries [19]. For this reason, research topics in these countries often focus on aspects that are more characteristic of the second or third periods we have identified [68, 69].

This document also features an alternative point of view provided at the International Economic Forum (2017),[8] according to which the main reform of pension systems should affect the funded pension elements since there is a positive impact of the latter on stable economic development [69]. This point of view is also supported by the Organization for Economic Cooperation and Development, which recommends the use of a set of measures to reform the elements of pension provision within the framework of a multilevel model [10].

CONCLUSIONS

The study made it possible to establish that the issues of using funded elements in international pension systems are quite popular in the works of Russian and foreign scientists. At the same time, the popularity of this type of research has increased significantly after the introduction of the funded elements at the national level, as well as during periods of instability of these elements (both nationally and internationally). As a result of the review, it was revealed that the factors of instability at different stages of the functioning of the funded elements differ. It is shown that the main ones, according to foreign researchers, are:

[7] Pension markets in focus. OECD, Private Pension Unit and Pension Statistics Group. November, 2019. URL: https://www.oecd.org/pensions/private-pensions/pensionmarketsinfocus.htm (accessed on 13.08.2020).

[8] Melbourne Mercer Global Pension Index. URL: https://info.mercer.com/rs/521-DEV-513/images/MMGPI%202019%20Full%20Report.pdf (accessed on 24.12.2019).

1) a lack of consideration of the institutional characteristics of the national pension system when introducing this element;

2) a national policy of investing pension savings expressed in the use of restrictions on their allocation in various asset types;

3) an incomplete coverage of the population when this element is introduced into the compulsory pension insurance system;

4) making private changes to the current system of funded pension provision since this is mainly a long-term element;

5) a reduction of pay-as-you-go elements and construction of compulsory pension insurance solely on the basis of funded elements or a significant predominance of the latter.

These conclusions were obtained by the authors based on the study of international experience in the use of the funded elements in pension systems.

Periodization of international studies devoted to the analysis of the efficiency of the funded elements of the pension system has been carried out. The study revealed that the issues of assessing the efficiency of the funded elements of the pension system receive the greatest development at the third or fourth stages, i.e. at moments of the high level of instability of the world economic system. This pattern can be traced in the pension systems of most countries, in which the share of the funded elements is more than 30%.

Various approaches to determining the efficiency of the funded elements of the pension system are shown. Various indicators of the efficiency of the funded elements are presented. Often these indicators are developed and proposed as a result of a study of world experience in the use of the funded elements of pension protection. The author grouped and systematized the normative and theoretical approaches presented in this study to highlight common elements. Generalized quantitative parameters of efficiency depend on the stage of the economic cycle and are indicators of the stability of both the national pension systems in general and the funded elements in particular. It is shown that the qualitative parameters of efficiency determine the degree of domination of the funded elements in the pension system.

The review showed that the choice in favor of the funded or pay-as-you-go schemes of pension protection for each country should be based on a deep and comprehensive economic analysis both when carrying out structural pension reforms and when improving particular elements.

The conducted cross-country analysis according to the criteria highlighted in the studies showed that pay-as-you-go pension systems, despite the active introduction of the funded elements into the pension systems of a number of foreign countries, generally demonstrate a greater level of stability and efficiency, and also better perform the task associated with a decent level of provision of the population.

As a result of the generalization of foreign experience in the use of funded elements and international studies of the final stage, we have identified the following possible directions for increasing the efficiency of the funded elements:

1) reduction in the dominance of the funded elements, since the latter often become an instability factor of the national economy;

2) development of additional regulations for the pension savings investment;

3) conducting accompanying macroeconomic reforms aimed at the development of the funded elements. This requires an efficient and sustainable national capital market.

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Analytical Generalization of the Depreciation Multiplier as a Factor of Extended Reproduction of Fixed Assets Depending on the Age Structure

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ABSTRACT

The **subject** of the study is the expansion multiplier as a quantitative characteristic of the depreciation expansive effect in models of the extended reproduction of fixed assets. The **aim** of the study is to identify the impact of the age structure of fixed assets on the expansion multiplier value factoring in various methods of calculating depreciation. The research **methods** include mathematical and computer modelling, as well as deductive logic as a process of reasoning from more general to more specific. The high depreciation of fixed assets of Russian enterprises and the high demand for depreciation as a source of funds for their renewal and extended reproduction ensure the **relevance** of the study. The **results** of the study include the models of extended reproduction of fixed assets due to the expansive depreciation effect using various methods of accruing depreciation; demonstrate the relationship between the age structure of fixed assets and the expansion multiplier. Generalizing the methods of depreciation in terms of their impact on the expansion multiplier values provides the **scientific novelty** of the research. This paper introduces the expansion multiplier calculation formulas for general and special accelerated depreciation and limits of multiplicative potential of accelerated depreciation. The **conclusions** of the research work illustrate the possibility of using the expansion multiplier to plan and optimize the depreciation policies of organizations, as well as to evaluate the multiplier of fixed assets in various economies. The authors identified the problems of applying the expansive depreciation effect as a means of extended reproduction of fixed assets in practice, as a result of the limitations of its theoretical models. In overcoming the identified limitations, areas of technical theoretical research are proposed.

Keywords: fixed assets; depreciation; expansion multiplier; depreciation multiplier; the Lohmann-Ruchti effect; expansive depreciation effect; extended reproduction; capital investment; accelerated depreciation; deceleration rate

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INTRODUCTION

According to various sources, the degree of fixed assets depreciation of Russian enterprises remains at a high level.[1] Their renewal is an important condition for increasing the competitiveness of domestic enterprises and their products both in the home and global markets. Finding funds aimed at updating the fleet of fixed assets is an urgent problem for many enterprises but political contradictions, high macroeconomic volatility, and business activity decrease as a result of various unpredictable factors (pandemic, emergencies, etc.) will only aggravate the business situation. The difficult conditions in which business entities find themselves as a result of the action of both economic factors and factors of a different nature, stimulate the search for sources of financing for their growth that go beyond the classical options –– loans and profits. Depreciation is one such source.

Depreciation is one of the most underestimated and understudied economic concepts. For a long time (often still) it was considered as a means of *simple reproduction* of fixed assets, with the help of which new similar equipment can be purchased to replace worn-out equipment. Thus, the "immortality" of the organization is achieved and at the same time, the principle of going concern in accounting is observed.

At the beginning of the XX century, the theory and practice of using *accelerated* (over straight-line method) depreciation methods were developing. However, the conscious and purposeful use of accelerated depreciation with the aim of using it as a source of capital investments was not carried out immediately. This was preceded by a long period of its use as a temporary tool to support the economy in wartime emergencies in England and the United States [1, 2].

Today, depreciation in advanced economies is the main source of the reproduction of fixed assets. Since the middle of the twentieth century, the share of depreciation in investment funds has been growing and its importance has been increasing. For example, in the USA, Germany, and Japan, depreciation is about 70, 65, and 50%, respectively [3].

In Russia, organizations have the right to charge depreciation with one of the following methods: straight-line method; diminishing balance method; method of writing off the value by the sum of the number of years of useful economic life; method of writing off the cost in proportion to the volume of products (works).[2] At the same time, accelerated methods of depreciation are not widely used in our country by economic entities. About three-quarters of enterprises use the straight-line depreciation method.[3] This is probably due to both the general inertia of business entities in the area of accounting practices they use and lack of knowledge on this issue. These and other factors increase the interest of scientists in the study of such an economic phenomenon as depreciation.

EXPANSION MULTIPLIER FOR STRAIGHT-LINE METHOD TO CALCULATE DEPRECIATION

For the first time, K. Marx and F. Engels considered depreciation as a source of funds that go beyond simple reproduction. They revealed the fact that if you use the straight-line method of calculating depreciation with the annual reinvestment of the depreciation fund in production, an increase in the volume of fixed assets occurs. Limiting himself to primary observation, Marx did not develop this concept. Only since the end of the first half of the XX century, this effect began to find its description and substantiation in the works of such

[1] Chichkin A. Wear and tear. Rossiyskaya Gazeta — Economy. № 143(5519). URL: https://rg.ru/2011/07/05/iznos.html (accessed on 10.06.2020).

[2] Accounting Regulations (PBU) 6/01 clause 18 "Accounting for fixed assets". URL: http://www.consultant.ru/document/cons_doc_LAW_31472/71350ef35fca8434a702b24b27e57b60e1162f1e/ (accessed on 10.06.2020).

[3] Methods for calculating the depreciation of fixed assets. Website Assistentus. URL: https://assistentus.ru/osnovnye-sredstva/sposoby-nachisleniya-amortizacii/ (accessed on 10.06.2020).

Table 1

Model of extended reproduction of fixed assets using the straight-line depreciation method, thousand rubles

Original cost of fixed assets	**100**	**25**	**31.25**	**39.06**	**48.83**	**36.04**	**38.79**	**40.68**	**41.08**
Fixed assets No. / Year	FA1	FA2	FA3	FA4	FA5	FA6	FA7	FA8	FA9
1	25								
2	25	6.25							
3	25	6.25	7.81						
4	25	6.25	7.81	9.77					
5		6.25	7.81	9.77	12.21				
6			7.81	9.77	12.21	9.01			
7				9.77	12.21	9.01	9.7		
8					12.21	9.01	9.7	10.17	
9						9.01	9.7	10.17	10.27
Total original cost	100	125	156.2	195.3	144.14	155.17	162.7	164.31	156.59

Source: author's calculations.

scientists as N. Grozdov, B. Horvat, M. Lohmann, G. Ruchti, M. Feldman, etc. This phenomenon and its quantitative measurement received various names and were associated with such terms, as the "Lohmann-Ruchti Effect", "expansion multiplier", "depreciation multiplier", etc. [4, 5].

Lohmann-Ruchti effect (expansion effect) — an economic effect that is manifested in the ability of depreciation to produce an extended reproduction of assets, limited in volume and in time, without using other sources of financing. This effect occurs when depreciation charges are periodically reinvested in the purchase of new items of fixed assets instead of accumulating them. Thus, the depreciation fund is transformed from a passive means of accumulation into an active means of production, and simple reproduction into extended ones. The quantitative expression of the expanded reproduction of fixed assets is the expansion multiplier (coefficient), the formula (1) [6, 7]:

$$M_{exp} = \frac{\sum OC_{FA}}{\sum OC_0} = \frac{N}{N_0}, \quad (1)$$

where M_{exp} — expansion multiplier; N or $\sum OC_{FA}$ — stable value of the equipment park or the total original cost of fixed assets, formed as a result of the annual reinvestment of depreciation charges; N_0 or $\sum OC_0$ — the original value of the equipment park or the total original cost of fixed assets.

Thus, the expansion multiplier shows how much the original cost of fixed assets in operation (the so-called total original cost) will increase as compared to its base level.

The model of extended reproduction of fixed assets using the straight-line depreciation method (*Table 1*) shows depreciation charges of a conditional organization

by years (lines) and fixed assets (columns), which acquired a fixed asset in the first year with an initial cost of 100 thousand rubles, useful life (UL) 4 years. The organization carries out expanded reproduction, reinvesting the amount of accumulated depreciation once a year. The depreciation method is a straight-line method. The input parameter of the model is highlighted in color, which is necessary for its construction and calculation of the amounts of depreciation charges.

Thus, the amount of accrued depreciation in the current year is used by the organization to acquire a new item of fixed assets in the next year, the depreciation amount of the *i*-year is equal to the original cost of *i* + 1 item of fixed assets.

Reaching a peak in the fourth year, the total original cost starts to decrease and subsequently fluctuates around some constant value. Moreover, the total original cost at any given time is greater than the amount invested in the purchase of the first fixed asset. So, in the ninth year, the total original cost of existing fixed assets will be 156.59 thousand rubles.

We calculate the values of the total original cost for each year as compared to the original of the first fixed asset. To do this, we will divide the total original cost of each year by 100 thousand rubles. (a basic indicator of dynamics).

After a certain number of years since the acquisition of the first item of fixed assets, the value of the basic indicator of dynamics, similar to the total original cost, stabilizes and varies around a certain constant value (*Table 2*). The value tends to the *expansion multiplier* of the item of fixed assets of the conditional organization.

Thus, the organization, without using the sources of external investment and without spending its own financial resources, due to depreciation is able to increase its fixed assets both in monetary and natural value, thereby carrying out expanded reproduction limited in volume and time.

The expansion multiplier is a relative measure, so a change in the acquisition value of the underlying asset does not affect its value. The factor influencing the expansion multiplier in the models of expanded reproduction of fixed assets is a useful life. Thus, when modeling the expanded reproduction of fixed assets with different useful economic lives, an increase in useful life ensures the expansion multiplier value increase.

Table 3 shows the dependence of the expansion factor on the useful economic life of fixed assets. The data from the table in the form of a graph are presented.

Figure 1 demonstrates that with an increase in the useful life, the value of the expansion multiplier also increases, but the growth of the curve slows down and it tends to a certain maximum value.

A large number of economists have contributed to the development of this area of economic science. The search for a theoretical substantiation of the expansion multiplier and a general formula for its calculation has become the object of a number of studies since the second quarter of the XX century. Thus, N. Grozdov, and later B. Horvat investigated the expansion multiplier using a straight-line method of calculating depreciation. One of the results of these studies was the formula for calculating the multiplier depending on the useful life, published by B. Horvat, the formula (2) [8, 9]:

$$M_{\exp} = 2\frac{UL}{UL+1}. \qquad (2)$$

This formula, also known as the "Horvat's depreciation multiplier", allows us calculating the expansion multiplier value without building a model, and drawing a conclusion about the multiplicative potential of the straight-line depreciation method [10–13].

$$\lim_{UL\to\infty} M_{\exp} = \lim_{UL\to\infty} 2\frac{UL}{UL+1} = 2. \qquad (3)$$

Table 2

The values of basic indicators of the dynamics of the total original cost

Year	1	2	3	4	5	6	7	8	...	19	∞
Basic indicator of dynamics	1	1.25	1.56	1.95	1.44	1.55	1.63	1.64	...	1.6	1.6

Source: author's calculations.

Table 3

Expansion multiplier value depending on the useful life of fixed assets (1–49 years) when using the straight–line depreciation method

×10 \ ×1	0	1	2	3	4	5	6	7	8	9
0	–	1	1.333	1.5	1.6	1.667	1.714	1.75	1.778	1.8
1	1.818	1.833	1.846	1.857	1.867	1.875	1.882	1.889	1.895	1.9
2	1.905	1.909	1.913	1.917	1.920	1.923	1.926	1.929	1.931	1.933
3	1.935	1.938	1.939	1.941	1.943	1.944	1.946	1.947	1.949	1.95
4	1.951	1.952	1.953	1.955	1.956	1.957	1.957	1.958	1.959	1.96

Source: author's calculations.

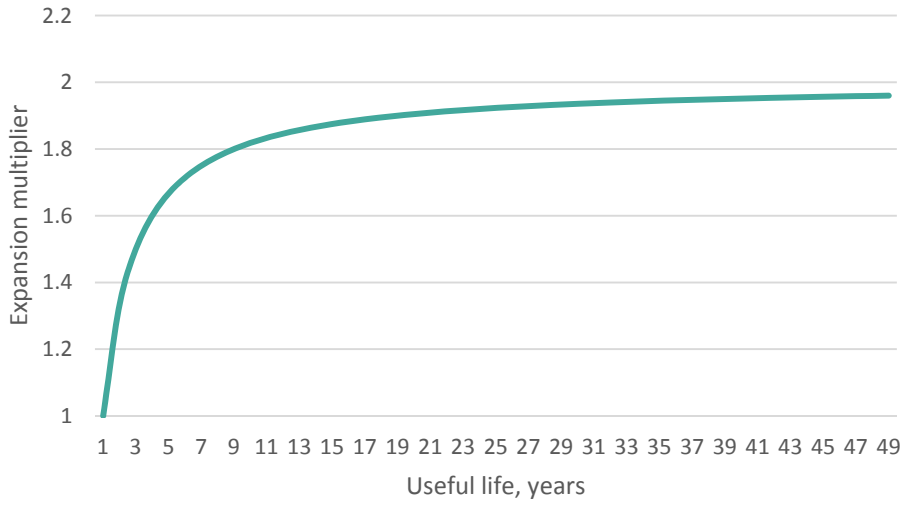

Fig. 1. **The values of the expansion multiplier depending on the useful life of fixed assets when using the straight–line depreciation method**

Source: compiled by the author based on *Table 3*.

With an increase in the UL, the expansion multiplier tends to two when using the straight-line method of calculating depreciation, the formula (3).

These and other studies were based on the assumption that the depreciation fund is reinvested once a year. Later, M. Feldman obtained a formula for calculating the expansion factor depending on the amount of equipment, which made it possible to more accurately calculate the result, not relying on the assumption of annual reinvestment of funds, but taking into account the real possible frequency of renewal of fixed assets.

Although the results of these and other studies helped to understand the value of depreciation as a means of expanded reproduction of fixed assets better, they were limited to the straight-line method of its accrual, which was relevant for its time. Today, the legislation of many countries, including Russia, allows the use of accelerated methods.

Such scientists as Berg, Waegenaere, Wielhouwer, Gazzola, Beretta, Mella, Lemarchand, Nikitin, Breif, Anton, etc. studies the problem of the depreciation multiplier [14–17].

Further studies of the theory of depreciation are necessary for the possibility of practical implementation of its multiplicative potential.

DECELERATION FACTOR

Different methods of calculating depreciation imply different methods for calculating the amount of depreciation by years of useful life. The diminishing-balance method, in contrast to the straight-line depreciation method, is calculated with the acceleration factor. It increases the annual depreciation rate and helps to speed up the transfer of the original cost of fixed assets to the cost of finished goods. The legislation establishes the procedure for calculating the amount of depreciation by years of useful life, based on the residual value of an item of fixed assets, the formula (4):

$$D_n = RV_{FA} \times N \times K, \quad (4)$$

where D_n — the amount of depreciation of the n-th year of the useful life; RV_{FA} — residual value an item of fixed assets; N — depreciation rate; K — acceleration factor.

However, this calculation method is not always convenient and cannot be sufficiently formalized. For the convenience of calculations, we use the *deceleration rate*.

The deceleration coefficient is an indicator reflecting how the amount of depreciation charges will change in the next year as compared to the previous one (chain indicator of dynamics). For example, for a straight-line method of calculating depreciation, this coefficient always equals to one, the formula (5):

$$Dec_{Lin} = \frac{D_{n+1}}{D_n} = \frac{OC_{FA} \times N}{OC_{FA} \times N} = 1, \quad (5)$$

where Dec_{Lin} — deceleration coefficient for a straight-line method of calculating depreciation.

The deceleration coefficient for a diminishing-balance depreciation method is different, the formulas (6), (7):

$$Dec_{DB} = \frac{D_{n+1}}{D_n} = \frac{\left(RV_{FA} - RV_{FA} \times N \times K\right) \times N \times K}{RV_{FA} \times N \times K} = 1 - N \times K. \quad (6)$$

Or:

$$Dec_{DB} = 1 - \frac{K}{UL}, \quad (7)$$

where Dec_{DB} — deceleration rate for a diminishing-balance depreciation method; RV_{FA} — residual value of an item of fixed assets; UL — useful life of an item of fixed assets.

Obviously, the deceleration factor does not depend on the original cost of the item of fixed assets and can be calculated without it on the basis of the acceleration factor and the useful life of an item of fixed assets (depreciation rate).

Table 4 shows the values of the deceleration rate for acceleration factors from 1 to 3 in increments of 0.2 and useful lives from 1 to 15 years. Along with the values of the deceleration rate of the method diminishing-balance method, the table also includes the value of the deceleration factor for the straight-line method of depreciation (Lin).

When using a deceleration factor to calculate the depreciation rates from the original cost, the following rules are applied:

1) the share of depreciation of the original cost of the first year is calculated as the difference between the unit and the deceleration rate;

Table 4

The values of deceleration rates for different pairs of acceleration factor and useful life when using the diminishing-balance depreciation method

		Lin	Diminishing balance: acceleration factor									
			1	1.2	1.4	1.6	1.8	2	2.2	2.4	2.6	2.8	3
Useful life	1	1	–	–	–	–	–	–	–	–	–	–	–
	2		0.5	0.4	0.3	0.2	0.1	–	–	–	–	–	–
	3		0.67	0.6	0.53	0.47	0.4	0.33	0.27	0.2	0.13	0.07	–
	4		0.75	0.7	0.65	0.6	0.55	0.5	0.45	0.4	0.35	0.3	0.25
	5		0.8	0.76	0.72	0.68	0.64	0.6	0.56	0.52	0.48	0.44	0.4
	6		0.83	0.8	0.77	0.73	0.7	0.67	0.63	0.6	0.57	0.53	0.5
	7		0.86	0.83	0.8	0.77	0.74	0.71	0.69	0.66	0.63	0.6	0.57
	8		0.88	0.85	0.83	0.8	0.78	0.75	0.73	0.7	0.68	0.65	0.63
	9		0.89	0.87	0.84	0.82	0.8	0.78	0.76	0.73	0.71	0.69	0.67
	10		0.9	0.88	0.86	0.84	0.82	0.8	0.78	0.76	0.74	0.72	0.7
	11		0.91	0.89	0.87	0.85	0.84	0.82	0.8	0.78	0.76	0.75	0.73
	12		0.92	0.9	0.88	0.87	0.85	0.83	0.82	0.8	0.78	0.77	0.75
	13		0.92	0.91	0.89	0.88	0.86	0.85	0.83	0.82	0.8	0.78	0.77
	14		0.93	0.91	0.9	0.89	0.87	0.86	0.84	0.83	0.81	0.8	0.79
	15		0.93	0.92	0.91	0.89	0.88	0.87	0.85	0.84	0.83	0.81	0.8

Source: author's calculations.

2) the share of depreciation of the original cost of the *n*- th year following the first (except for the last) is calculated as the product of the share of the previous *n* — 1 year and the deceleration rate;

3) the share of depreciation of the original cost of the last year is calculated as the difference between the unit and the sum of shares for previous years (the share of the residual value).

Thus, the calculation of the share of depreciation of the original cost of the *n*- th year (except for the last) can be expressed by the formula (8):

$$\%D_n = (1 - Dec) \times Dec^{n-1}. \quad (8)$$

And the share of depreciation of the last year — to the formula (9):

$$\%D_{UL} = 1 - \sum_{n=1}^{UL-1} (1 - Dec) \times Dec^{n-1} = Dec^{UL-1}, \quad (9)$$

where $\%D_n$ — the share of depreciation of the original cost of *n*-th year of the useful life.

For the sake of convenience in calculations, the last two formulas can be expressed by one (Heaviside step function), the formula (10):

$$\%D_n = (1 - Dec) \times Dec^{n-1} \times 0^{0^{UL-n}} + Dec^{UL-1} \times 0^{UL-n}. \quad (10)$$

The use of the deceleration factor for calculating depreciation charges seems preferable, since the number of required settlement operations can be reduced, and instead of calculating the absolute amounts of depreciation charges for years of useful life, calculate the shares of depreciation charges of the original cost.

Table 5 contains the calculated shares of depreciation charges of the original cost for

Table 5

Depreciation share of the original cost by useful life of assets, depending on the deceleration rate

K_{dec}	Useful life, year									
	1	2	3	4	5	6	7	8	9	10
0.1	0.9	0.09	0.009							
0.2	0.8	0.16	0.032							
0.3	0.7	0.21	0.063	0.019						
0.4	0.6	0.24	0.096	0.038	0.015					
0.5	0.5	0.25	0.125	0.063	0.031	0.016				
0.6	0.4	0.24	0.144	0.086	0.052	0.031	0.019			
0.7	0.3	0.21	0.147	0.103	0.072	0.050	0.035	0.025	0.017	0.012

Source: author's calculations.

some deceleration factors (from 0.1 to 0.7 in increments of 0.1). It provides the possibility of applying deceleration factors for fixed assets with specified useful lives. The shares of depreciation charges of the original cost with the same deceleration rates are equal, only the useful life and the duration of depreciation are different.

The highlighted cells of the table show the limits of the useful life in relation to a specific value of the deceleration coefficient. Thus, the useful life of fixed assets with a deceleration factor of 0.1 can range from 2 to 3 years, and the deceleration rate of fixed assets with a useful life of more than four years will always be greater than 0.3. The data from the above table matches the *Table. 4*.

The deceleration rate for the straight-line method and the method of diminishing-balance has the same economic value –– it shows the size of the share of depreciation of the future period relative to the previous one. The straight-line method and the method of diminishing-balance are calculated using various methods, and it is a complex task to compare them. The use of the deceleration factor makes it possible to reduce the methods of calculating depreciation to a single comparable indicator [18].

MODELING OF EXTENDED REPRODUCTION OF FIXED ASSETS WHEN USING THE DIMINISHING-BALANCE DEPRECIATION METHOD

We model the extended reproduction of fixed assets by years and items of fixed assets for the diminishing-balance method of depreciation. Suppose there is a fixed asset with an original value of 100 thousand rubles, with a useful life of 4 years. The acceleration factor for the diminishing-balance depreciation method equals three.

Modeling was carried out in a Microsoft Excel 2019spreadsheet. For more accuracy, the depreciation charges were calculated up to the year 100th. The expansion multiplier was found as the quotient of dividing the total original cost of year 100 by the total original cost of the first year of the fixed asset.

We find the deceleration rate for the model under consideration, the formula (11), and the share of depreciation of the original cost (*Table 6*).

$$Dec = 1 - \frac{K}{UL} = 1 - \frac{3}{4} = 0.25. \qquad (11)$$

We construct a table reflecting the structure and dynamics of depreciation charges by year and by items of fixed assets (*Table 7*).

Table 6

Depreciation share of the original cost by useful life of assets when using the diminishing-balance depreciation method

Year	1	2	3	4
Depreciation share of the original cost	0.75	0.1875	0.046 875	0.015 625

Source: author's calculations.

Table 7

Model of extended reproduction of fixed assets when using the diminishing-balance depreciation method, thousand rubles

Original costs of fixed assets	**100**	**75**	**75**	**75**	**75.39**	**75.29**	**...**	**75.29**
Fixed assets No. / Year	FA1	FA2	FA3	FA4	FA5	FA6	...	FA100
1	75							
2	18.75	56.25						
3	4.69	14.06	56.25					
4	1.56	3.52	14.06	56.25				
5		1.17	3.52	14.06	56.54			
6			1.17	3.52	14.14	56.47	...	56.47
7				1.17	3.53	14.12	...	14.12
8					1.18	3.53	...	3.53
9						1.18	...	1.18
Total original cos	100	175	250	325	300.39	300.68	...	301.17

Source: author's calculations.

The depreciation charges of the first three years are constant and equal to depreciation of the first year of operation of the item of fixed assets. Based on such an observation, one can make a hasty conclusion about the invariability of the depreciation costs when using the diminishing-balance method but further calculations show that this is not the case. As in the case of using the straight-line method, the depreciation fluctuates over the years and tends to a certain fixed value.

$$M_{\text{exp}} = \frac{301.17}{100} = 3.012. \quad (12)$$

The expansion multiplier achieved by the organization on the 100th year is 3.012, the formula (12), which is 1.88 times more than when a straight-line method of calculating depreciation is used by the organization. Modelling the depreciation costs in a similar way, we find the values of the expansion multiplier for different pairs of acceleration factors and useful life of assets.

Table 8

The values of the expansion multiplier for different pairs of acceleration factors and useful life of assets

		Acceleration factor									
		1	1.4	1.6	1.8	2	2.2	2.4	2.6	2.8	3
Useful life	2	1.333	1.538	1.667	1.818	2.000	–	–	–	–	–
	3	1.421	1.650	1.781	1.923	2.077	2.243	2.419	2.606	2.801	3.000
	4	1.463	1.704	1.838	1.981	2.133	2.294	2.463	2.640	2.823	3.012
	5	1.487	1.736	1.872	2.017	2.169	2.328	2.495	2.668	2.847	3.031
	6	1.504	1.757	1.895	2.040	2.192	2.352	2.517	2.689	2.866	3.048
	7	1.515	1.772	1.911	2.057	2.210	2.369	2.534	2.705	2.881	3.061
	8	1.523	1.783	1.923	2.069	2.223	2.382	2.547	2.717	2.892	3.072
	9	1.530	1.791	1.932	2.079	2.233	2.392	2.557	2.727	2.901	3.080
	10	1.535	1.798	1.939	2.087	2.241	2.400	2.565	2.735	2.909	3.087
	11	1.540	1.803	1.945	2.093	2.247	2.407	2.572	2.741	2.915	3.093
	12	1.543	1.808	1.950	2.098	2.253	2.412	2.577	2.747	2.920	3.098
	13	1.546	1.812	1.954	2.103	2.257	2.417	2.582	2.751	2.925	3.102
	14	1.549	1.815	1.958	2.107	2.261	2.421	2.586	2.755	2.929	3.106
	15	1.551	1.818	1.961	2.110	2.265	2.425	2.589	2.759	2.932	3.109

Source: author's calculations.

The diminishing-balance method of calculating depreciation has the greatest multiplicative effect as compared to other methods and ranges from 1.33 to 3 and more (*Table 8*). In addition, unlike other methods, in which the values of the expansion multiplier are rigidly tied to the useful life, the diminishing-balance method allows changing the expansion multiplier over a wide range of values.

MODELLING OF EXTENDED REPRODUCTION OF FIXED ASSETS WHEN USING THE SUM OF YEARS DIGIT METHOD OF CALCULATING DEPRECIATION

Similarly, we model the extended reproduction of fixed assets for the depreciation method according to the sum of years of useful life. We leave the conditions unchanged.

The legislation establishes the procedure for calculating the depreciation charges when using the sum of the years' method, based on the original cost of an item of fixed assets, the formula (13):

$$D_n = OC_{FA} \times \frac{t}{T}, \quad (13)$$

where t — years, un-depreciated useful life; T — sum of the number of years (cumulative).

Having calculated the share of depreciation of the original cost by years of useful life (*Table 9*), we will construct a model for extended reproduction of fixed assets, reflecting the structure and dynamics of depreciation charges by years and fixed assets when using the depreciation method by the sum of the number of years of useful life (*Table 10*).

We find the value of the expansion multiplier, the formula (14):

Table 9

Depreciation share of the original cost by useful life of assets when an organization uses the sum of years method of calculating depreciation

Year	1	2	3	4
Depreciation share of the original cost	0.4	0.3	0.2	0.1

Source: author's calculations.

Table 10

Model of extended reproduction of fixed assets when using the sum of years of useful life method of calculating depreciation, thousand rubles

Original cost of fixed asset	**100**	**40**	**46**	**50.4**	**51.96**	**49.91**	**...**	**50**
Year \ Fixed asset No.	FA1	FA2	FA3	FA4	FA5	FA6	...	FA100
1	40							
2	30	16						
3	20	12	18.4					
4	10	8	13.8	20.16				
5		4	9.2	15.12	19.64			
6			4.6	10.08	14.73	19.96	...	20
7				5.04	9.82	14.97	...	15
8					4.91	9.98	...	10
9						4.99	...	5
Total original cost	100	140	186	236.4	188.36	201.37	...	200

Source: author's calculations.

$$M_{exp} = \frac{200}{100} = 2. \quad (14)$$

The expansion multiplier equals 2, which is 1.25 times more than when the company uses the straight-line depreciation method, but 1.5 times less than when the company uses the diminishing-balance method.

Modeling the expanded reproduction of fixed assets, we find the values of the expansion multiplier depending on the asset's useful life.

Table 11 shows the values of the expansion multiplier for different values of the useful life. For clarity, *Table 11* data are presented as a graph.

Figure 2 clearly demonstrates how with an increase in the useful life, the value of the expansion multiplier also increases, but the growth of the curve slows down, and it tends to a certain maximum value. With equal useful life, the value of the expansion multiplier when using the sum of years method is higher than when using the straight-line depreciation method [19].

Table 11

The values of the expansion multiplier depending on the useful life of assets (1–49 years) when using the sum of years method of calculating depreciation

×10 \ ×1	0	1	2	3	4	5	6	7	8	9
0	–	1	1.5	1.8	2	2.143	2.25	2.333	2.4	2.455
1	2.5	2.538	2.571	2.6	2.625	2.647	2.667	2.684	2.7	2.714
2	2.727	2.739	2.75	2.76	2.769	2.778	2.786	2.793	2.8	2.806
3	2.813	2.818	2.824	2.829	2.833	2.838	2.842	2.846	2.85	2.854
4	2.857	2.86	2.864	2.867	2.87	2.872	2.875	2.878	2.88	2.882

Source: author's calculations.

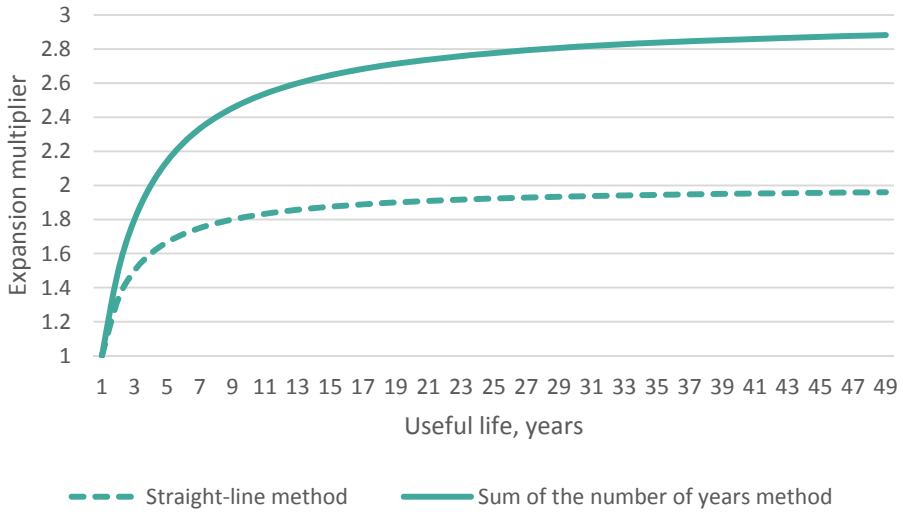

Fig. 2. **The values of the expansion multiplier depending on the useful life of assets when using the sum of years method of calculating depreciation**

Source: compiled by the author based on *Table 11*.

The considered models of extended reproduction of fixed assets allow us to make a number of important observations:

— Extended reproduction, carried out at the expense of the depreciation fund, is limited both in terms of the time of its implementation and in volume. Different methods of depreciation are characterized by different values of the expansion multiplier. Thus, the diminishing-balance method has the greatest multiplicative effect of the considered methods of depreciation, and the straight-line depreciation method — the least.

The result of the expansive effect of depreciation is ensured by the fact that both the depreciation charges amounts equate to each other, and the total original cost is equally distributed across all items of fixed assets in operation.

THE IMPACT OF THE AGE STRUCTURE OF FIXED ASSETS ON THE VALUE OF THE EXPANSION MULTIPLIER

The straight-line depreciation models of domestic and foreign authors, as well as the accelerated depreciation models, previously dis-

Table 12

Combinations that correspond to the methods of calculating depreciation before and after extended reproduction

Before \ After	Straight-line	Diminishing-balance	Sum of years
Straight-line	Lin-Lin	Lin-DB	Lin-SOY
Diminishing-balance	DB-Lin	DB-DB	DB-SOY
Sum of years	SOY-Lin	SOY-DB	SOY-SOY

Source: compiled by the author.

cussed in this paper (standard models), clearly demonstrate the dependence of the expansion multiplier on factors such as useful life and acceleration factor. However, they are not sufficient to be relevant to the real aspects of the economy. Thus, the standard models are based on the assumption that fixed assets are considered new assets that have just come into operation. In a situation close to the real one at the moment when the organization decides to start the implementation of expanded reproduction, the same type of fixed assets of the enterprise can be characterized by different age structure and original (residual) costs. Models that consider this and a number of other factors described below will be called regressive, and the depreciation multiplier, respectively, the regressive expansion multiplier.

The meaning of the regressive expansion multiplier is important and worth mentioning. If, when considering standard models, the amount of accumulated depreciation of fixed assets attributed to the original object was absent (due to its novelty), then it takes place when considering regressive models. This raises the following question: is it necessary to take into account the amount of accumulated depreciation as a result of simple reproduction for the purpose of calculating the expansion multiplier in regression models? Thoughtful reasoning leads the researcher to the conclusion that there is no need to take it into account. The amounts of the original cost of these assets in the process of operation through depreciation increased the cost of finished goods and ultimately accumulated in the form of cash on the current account. If the enterprise has established control over the targeted spending of the accumulated depreciation fund, the accumulated depreciation will be reinvested in full. However, since they are associated with retained earnings of the organization, it is rational to take into account only the "potential" depreciation charges for calculating the regressive expansion multiplier, i.e. those that will accrue to items of fixed assets in future periods. The funds of the current account, albeit "depreciation", invested in production for the acquisition of fixed assets, in essence do not differ from other sources of financing and have an equal maximum multiplicative potential of new fixed assets.

The expansion multiplier is a relative indicator and when the absolute value of the original cost changes within the framework of standard models, its value does not change. Regressive models are characterized by several items of the same type of fixed assets with the same useful lives, but different original cost and years of their operation. This leads to the fact that the age structure and the original cost of fixed assets in regressive models become a factor of the expansion multiplier.

Additionally, the enterprise in the process of carrying out its economic activities may change the methods of calculating the depreciation of fixed assets. Taking this fact into account should also be reflected in re-

Table 13

Comparative characteristics of standard and regression models of extended reproduction of fixed assets

Standard models	Regression models
Fixed assets are new and their operational cycle starts from the first year	Fixed assets are characterized by a certain age structure: there are both new and old ones
The depreciation method has not been changed	The depreciation method after the expanded reproduction start may change
Extended reproduction is carried out from the first year	Extended reproduction is carried out starting from the second year or later

Source: compiled by the author.

Table 14

Example of a regression model of extended reproduction of fixed assets, thousand rubles

	Before				After				
Original cost	**75**	**0**	**25**	**0**	**25**	**16.25**	**20.25**	**...**	**18.75**
Year \ Fixed asset No.	FA1	FA2	FA3	FA4	FA5	FA6	FA 7	...	FA100
1	18.75	0	6.25	0					
2		0	6.25	0	10				
3			6.25	0	7.5	6.5			
4				0	5	4.88	8.1	...	7.5
5					2.5	3.25	6.08	...	5.63
6						1.63	4.05	...	3.75
7							2.03	...	1.88
Total original cost	75	75	100	100	50	66.26	61.52	...	75

Source: author's calculations.

gressive models that claim to be "close to the real economy". As a result of the three considered methods of calculating depreciation, the number of their combinations corresponding to the method of calculating depreciation before and after extended reproduction is $3^2 = 9$. For brevity, we denote each method of calculating depreciation: Lin — straight-line method of calculating depreciation; DB — diminishing-balance method of calculating depreciation; SOY — a method of calculating depreciation according to the sum of the number of years in an asset's useful life (*Table 12*).

Thus, for the purpose of overcoming the white spots of the theory of depreciation in

Table 15

The effect of changes in the year of operation on the expansion multiplier in absolute and relative values for nine different situations when the methods of calculating depreciation change

No. u/l	Year / Changes	Absolute values				Relative values			
		1	2	3	4	1	2	3	4
1	Lin–Lin	0.4	0.8	1.2	**1.6**	25%	50%	75%	100%
2	Lin–DB	0.753	1.506	2.259	**3.012**	25%	50%	75%	100%
3	Lin–SOY	0.5	1	1.5	**2**	25%	50%	75%	100%
4	DB–Lin	0.025	0.1	0.4	**1.6**	1.56%	6.25%	25%	100%
5	DB–DB	0.047	0.188	0.753	**3.012**	1.56%	6.25%	25%	100%
6	DB–SOY	0.031	0.125	0.5	**2**	1.56%	6.25%	25%	100%
7	SOY–Lin	0.16	0.48	0.96	**1.6**	10%	30%	60%	100%
8	SOY–DB	0.301	0.904	1.807	**3.012**	10%	30%	60%	100%
9	SOY–SOY	0.2	0.6	1.2	**2**	10%	30%	60%	100%

Source: author's calculations.

terms of the expansion multiplier, it is proposed to build and analyze regressive models of extended reproduction of fixed assets, which have a number of distinctive features (*Table 13*).

Table 14 presents an example of building a regression model of expanded reproduction corresponding to the combination "Lin–SOY". By the time the expanded reproduction begins, the organization has two items of fixed assets (FA) with a useful life of 4 years: FA1 with an original cost of 75 thousand rubles in the fourth year of operation and FA3 with an original cost of 25 thousand rubles in the second year of operation.

There is no extended reproduction of fixed assets until the fourth year, and depreciation is not carried over to the original cost of fixed assets in the following year. From the moment the item of fixed assets FA5 is put into operation, the enterprise begins to carry out expanded reproduction and transfer the amounts of accrued depreciation to the original cost of newly introduced fixed assets.

$$M_{\text{exp}} = \frac{75}{100} = 0.75. \quad (15)$$

For the regressive model of expanded reproduction considered as an example, the value of the expansion multiplier is 0.75, the formula (15). Compared to the standard model of expanded reproduction, when using the depreciation method based on the sum of the number of years of an asset's useful life, this is more than 2.5 times lower value of the expansion multiplier. Thus, as a result of expanded reproduction, the total original cost will decrease in the future. This is due to the fact that fixed assets in the process of obsolescence lose their multiplicative potential relative to the multiplicative potential of new items of fixed assets (hence the name of this type of model).

The analysis of regressive models revealed that in the case when fixed assets are distributed over the years in equal shares, the implementation of expanded reproduction using the same method of depreciation does not give a multiplier effect and the expansion multiplier is equal to 1. Any process of expanded repro-

Table 16

Dynamics of depreciation costs for the total original cost depreciation in the first year of the useful life of assets

Year \ FA No.	FA1	FA2	FA3	FA4	FA5	FA6
1	1					
2	0	1				
3	0	0	1			
4	0	0	0	1		
5		0	0	0	1	
6			0	0	0	1

Source: compiled by the author.

duction considered earlier, both within the framework of standard and regression models, led to a situation where their total original cost was equally distributed among all items of fixed assets.

We consider the effect of changing the year of operation of a fixed asset on the regressive expansion multiplier. To do this, we will find its values for each year of the useful life of assets, excluding the influence of other years of the useful economic life, sequentially substituting an original non-zero cost in each of the cells, nullifying all others. The data from nine models are presented in a more convenient form (*Table 15*). We also calculate the basic indicator of the dynamics by years of operation. As a comparison base, we take the values of the expansion multiplier for new fixed assets in the first year of operation (the far right column), the values of the regressive expansion multiplier of which are equal to the expansion multiplier for standard models of expanded reproduction of fixed assets.

Table 15 data show that:

• The depreciation method used by the organization prior to the commencement of expanded reproduction determines how the values of the regressive expansion factor by years of useful life will relate to the base value of the expansion multiplier. The table can be conditionally divided into three groups with the same relative values of the expansion multiplier (1–3; 4–6; 7–9). Percentage relative to the baseline expansion multiple is a fraction of the residual value relative to the original cost.

• The method of depreciation used by the organization after the start of expanded reproduction determines the maximum value of the expansion multiplier. The table can be conditionally divided into three groups according to the equality of the maximum value of the expansion multiplier: 1, 4, 7; 2, 5, 8 and 3, 6, 9.

Thus, the data of the *Table. 15* allow us to conclude that only residual value takes part in the regressive models of expanded reproduction. The total original cost can be calculated as the product of the residual value and the expansion multiplier (for the standard model) corresponding to the depreciation method after the start of expanded reproduction. In turn, the expansion multiplier for the regression model can be calculated using the formula (16):

$$\overline{M_{exp}} = \frac{RV_{FA} \times M_{exp}}{OC_{FA}} = \overline{LC} \times M_{exp}, \qquad (16)$$

where $\overline{M_{exp}}$ — regressive expansion multiplier; M_{exp} — expansion multiplier value for the standard model; LC — life coefficient.

Table 17

Dynamics of depreciation costs for the total original cost depreciation in the second year of the useful life of assets

Year \ FA No.	FA1	FA2	FA3	FA4	FA5	FA6	FA7	FA8
1	0							
2	1	0						
3	0	0	0					
4	0	0	1	0				
5		0	0	0	0			
6			0	0	1	0		
7				0	0	0	0	
8					0	0	1	0

Source: compiled by the author.

Table 18

Dynamics of depreciation costs for the total original cost depreciation in the third year of the useful life of assets

Year \ FA No.	FA1	FA2	FA3	FA4	FA5	FA6	FA7	FA8
1	0							
2	0	0						
3	1	0	0					
4	0	0	0	0				
5		0	0	0	0			
6			0	1	0	0		
7				0	0	0	0	
8					0	0	1	0

Source: compiled by the author.

Thus, having identified the patterns of the impact of the age structure of fixed assets on the expansion multiplier, for the purposes of further analysis, we can limit ourselves to the study of three models corresponding to three different methods of depreciation, which, in turn, correspond to the methods used by the organization after the start of expanded reproduction. If the residual and original costs provide information support for accounting and are known for the organization, then the value of the expansion multiplier is the subject of theoretical research.

THEORETICAL BASIS AND ANALYTICAL GENERALIZATION OF THE EXPANSION MULTIPLIER

The three considered cases of expanded reproduction due to the multiplicative effect of the depreciation of fixed assets have different eco-

nomic effects. With all the differences in the methodology for calculating depreciation, the difference between them comes down to one thing: different methods of calculating depreciation in different proportions distribute the original cost over the years of the useful life of assets.

Each next year, the accumulated amount of depreciation charges is reinvested in production. The amounts of the original cost are different from year by year, which cannot be applied to the proportions of its distribution in the form of depreciation charges between the years of the useful life –– they are always the same and are determined by the method of calculating depreciation.

We assume the possibility of using the depreciation method, in which the shares of the original cost are randomly distributed over the years of the useful life. Let there be a fixed asset with a useful life of 4 years. We consider four cases.

In the first case (*Table 16*), the organization depreciates the entire amount of the original cost in the first year of operation of the items of fixed assets. In this case, the organization can reinvest the entire original cost of the fixed asset every year. The result of this in the future will be the simultaneous operation of four items of fixed assets at the enterprise.

In the second case (*Table 17*), the organization depreciates the entire amount of the original cost in the second year of operation of the items of fixed assets, reinvests the entire original cost of the fixed asset every two years, since the depreciation is not charged in the first year of operation of fixed assets. This is reflected by the columns corresponding to the fixed asset items with even numbers since the basis for their calculation is zero. The result of this in the future will be the simultaneous operation of two items of fixed assets at the enterprise.

In the third case (*Table 18*), the organization depreciates the entire amount of the original cost for the third year of operation of the items of fixed assets, reinvesting the entire original cost of the fixed asset every three years. The result of this in the future will be the simultaneous presence of one or two items of fixed assets at the enterprise. Thus, in the sixth and seventh year one — the fourth item of fixed assets — will be in operation, and in the eighth year — two: the fourth and seventh. On average, this gives 1.33 items of fixed assets, existing simultaneously in the future.

In the last, fourth case, the organization depreciates the entire amount of the original cost for the fourth year of operation of fixed assets. The result of this in the future will be the simultaneous operation at the enterprise of only one item of fixed assets.

Obviously, the simultaneous presence of the n-th number of fixed assets at the enterprise is nothing more than a quantitative measurement of expanded reproduction using the expansion multiplier. Thus, isolated from the influence of other years of useful life, the values of the expansion multiplier are in the range from 1 to useful economic life and can be calculated using the formula (17):

$$I_n = \frac{UL}{n}, \qquad (17)$$

where I_n — expansion multiplier of the n-th year, isolated from the impact of other years of the useful life; n — year of useful life.

Since in standard methods of calculating depreciation, the amount of the original cost is distributed in a certain proportion between all the useful lives, the found values of the isolated expansion multiplier require averaging using a harmonic weighted average, the weights in which will be the shares of depreciation of the original cost, the formula (18):

$$M_{\exp} = \frac{1}{\frac{\%D_1}{I_1} + \frac{\%D_2}{I_2} + \ldots + \frac{\%D_{UL}}{I_{UL}}} = \frac{UL}{\sum_{i=1}^{UL} i \times \%D_i}, \qquad (18)$$

where $\%D_n$ — the share of depreciation of the original cost of fixed assets of the n-th year.

The resulting formula for calculating the expansion multiplier is the most general and is suitable for calculating its value for any

method of calculating depreciation. It allows us to derive special formulas for calculating the expansion multiplier for the diminishing-balance method and for the sum of the number of years of the useful life of assets.

For the formula for calculating the expansion multiplier of the diminishing-balance method, we use the deceleration factor, the formulas (19), (20):

$$M_{\exp.DB} = \frac{1}{\frac{(1-Dec)\times Dec^{0}}{UL/1} + \frac{(1-Dec)\times Dec^{1}}{UL/2} + \ldots + \frac{Dec^{UL-1}}{UL/UL}} = \frac{UL}{\sum_{i=1}^{UL} Dec^{i-1}} \quad (19)$$

or

$$M_{\exp.DB} = \frac{UL\times(Dec-1)}{Dec^{UL}-1}. \quad (20)$$

We find the value to which the expansion multiplier tends for the diminishing-balance depreciation method with an increase in the useful life, the formula (21):

$$\lim_{UL\to\infty} M_{\exp.DB} = \lim_{UL\to\infty} \frac{UL\times(Dec-1)}{Dec^{UL}-1} = \lim_{UL\to\infty} \frac{UL\times\left(\left(1-\frac{K}{UL}\right)-1\right)}{\left(1-\frac{K}{UL}\right)^{UL}-1} = \frac{Ke^{K}}{e^{K}-1}, \quad (21)$$

where K — acceleration factor; *e* — Euler's number.

For the maximum permissible acceleration factor established by law (K = 3), the multiplier will be:

$$\lim_{UL\to\infty} M_{\exp.DB(K=3)} = \frac{3e^{3}}{e^{3}-1} \approx 3.157. \quad (22)$$

Similarly, we derive a special formula for calculating the expansion multiplier for the method by the sum of the number of years of the useful life of assets, the formula (23):

$$M_{\exp.SNY} = \frac{1}{\frac{UL}{UL/1} + \frac{UL-1}{UL/2} + \ldots + \frac{1}{UL/UL}} = 3\frac{UL}{UL+2}. \quad (23)$$

We find the value to which the expansion multiplier tends for the depreciation method based on the sum of the number of years of the useful life with an increase in the useful economic life of assets, the formula (24):

$$\lim_{UL\to\infty} M_{\exp.SNY} = \lim_{UL\to\infty} 3\frac{UL}{UL+2} = \lim_{UL\to\infty} 3\frac{1}{1+\frac{2}{UL}} = 3. \quad (24)$$

Thus, if the general formula for calculating the expansion multiplier allows us to find the value of the expansion multiplier based on the annual shares of depreciation of the original cost, special formulas can be used both to calculate the value of the expansion multiplier and to find the limits of the multiplicative potential of methods for calculating depreciation.

CONCLUSIONS

All three considered methods of calculating depreciation have different potential for extended reproduction. The maximum values of the expansion multiplier are: for the straight-line depreciation method –– 2; for the diminishing-balance method –– 3.157 and for the method of depreciation according to the sum of the number of years in an asset's useful life ––3. The method of diminishing-balance has the greatest potential and flexibility for the purposes of implementing expanded reproduction. Unlike other methods of calculating depreciation, it is characterized by the maximum possible expansion multiplier and allows wide adjustment of its value.

The obtained general and special formulas for calculating the expansion multiplier are critical for planning and forecasting the reproduction of fixed assets by business entities. They can be used to form and optimize the depreciation policy of enterprises. At the same time, the assumptions on which they are based limit the scope of their application to theoretical models and those close to real estimates of the expanded reproduction.

The main assumption that distorts the expansion multiplier in theoretical models is the fact that the depreciation fund is reinvested

annually. Though such a policy can be implemented by the enterprise in practice, it is not preferable. In a real economy, an enterprise can implement this process both more often and less often. More often, if for a period of time less than a year, the organization is able to accumulate funds sufficient to purchase a new item of fixed assets. In this case, newly acquired items of fixed assets generate a stream of depreciation charges, which increase expanded reproduction. Later, if the funds accumulated by the organization within a year are not enough to purchase one item of fixed assets. It is also true that the expansion multiplier depends not so much on the useful life as on the number of fixed assets of the enterprise.

Another assumption that distorts the expansion multiplier is that the depreciation fund may be used to implement expanded reproduction, becoming a means for acquiring fixed assets in volume and value in proportion to the current (assuming that the production structure of the organization is optimal). Excessive acquisitions of production assets with high expansion potential and small acquisitions of assets with low expansion potential at the same time will make some production assets ineffective, bringing the production structure out of its optimal state. To overcome this, it is preferable to use the funds accumulated as a result of depreciation of some funds for the acquisition of others in order to ensure their proportional commissioning, which, in turn, raises questions about the quantitative characteristics of such replacement reproduction and its impact on the final expansion multiplier.

These and other factors reduce accuracy and limit the use of the expansion multiplier in enterprises. Overcoming them is an important scientific, methodological, and practical task but it is beyond the scope of this article.

Expanded reproduction of fixed assets, realized through depreciation, imposes a number of restrictions on its implementation. However, it should be considered that with the same depreciation methodology, it can be implemented only once. At the end of the expansion cycle, the amounts of fixed assets received will be split equally among items of fixed assets on all years of useful life from 1 to the last year of useful life. In such conditions, additional expanded reproduction already carried out without changing the method of depreciation using the method with a large multiplicative potential is impossible.

Multiplicative models and conclusions based on them allow to approximately estimate the multiplicative potential of expanded reproduction of fixed assets at different scales of the economy. Thus, according to the degree of depreciation of fixed assets (at the enterprise, in the industry, in the state, etc.), the prospects for the implementation of expanded reproduction can be judged and a quantitative estimation can be given.

The expansion multiplier is a quantitative characteristic of the expansive effect of depreciation, the effect that is a consequence of the essence of fixed assets –– their long-term use. This natural effect today is increasingly reflected in the implementation of expanded reproduction, which was not evident for economists of the past, who considered depreciation as a means of simple reproduction.

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Influence of Non-Price Factors of Banks' Activities on their Financial Results

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ABSTRACT

The **subject** of the research is the customer motivation towards certain banks regardless of the pricing policy. The **aim** of this study is to determine the significance of non-price factors for attracting customers by banks and its influence on banks' revenues and profit. The **theoretical and methodological basis** of the study included the scientific works of foreign scientists on the influence of non-price factors on customer loyalty in banking. The author used **methods** of qualitative and quantitative analysis of scientific publications, regulatory and legal sources, retrospective statistical data, and analytics of well-known consulting firms. The **results** of the study suggest areas for improvement for commercial banks in terms of the quality of values (non-price) offered to customers and approaches to understanding customer loyalty. The author **concludes** that despite the importance of banking services cost reduction and thus intensifying competition, a constant focus on cutting prices, which are relatively the same for all banks in terms of product range and basic conditions, does not necessarily contribute to expanded market share and profitability of financial institutions, while a comprehensive understanding of customer needs, timely and relevant offers, a personalized customer service, as well as a bank's shifting focus from a product to a customer problem-solving approach will help banks to attract customers, improve their loyalty, increase service sales and expand the product range, ultimately, spurring growth and better economics for banks.

Keywords: customer; bank; service; technology; loyalty; preference; personalization; quality

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INTRODUCTION

In recent years, the activities of traditional commercial banks have become more complicated with the emergence of new players in the banking sector: digital banks and high-tech companies. Rivalry with them manifested itself, first of all, in competition on prices for products offered to customers. However, such competition is difficult for traditional banks since they still have large branch networks, complex internal procedures focused on selling products, rather than meeting customers' needs by providing banking services. Regulators have significantly tightened capital requirements, credit risk assessments, customer compliance with the legality of transactions, data security while encouraging competition with non-banking institutions to improve customer service. These circumstances reduce banks' income base and increase their expenses. In these conditions, incumbent banks need to look for new sources of income, one of the categories of which are value priorities for customers.

VALUE PRIORITIES OF THE BANKING CUSTOMERS

The performance of any bank largely depends on the ability to raise funds, place them, and serve customers. These opportunities are determined by the industry focus of the operations, the chosen customer segment, the phase of the economic cycle, and the business model adopted by the bank.

The bank's ability to introduce modern technologies to simplify and speed up internal banking procedures and reduce the cost of operations, ensure their security from internal and external attacks on the bank and customer data, as well as to ensure the easiest possible access to banking services for customers, and, more recently, the provision of non-banking services to clients has a significant impact on the bank efficiency.

Enhancing the mechanism of the bank's operations is aimed at improving the profitability and meeting the expectations of the bank's shareholders regarding the returns on their in-

vestments in the bank's capital. Achieving these goals largely depends on how successfully the bank will be able to attract the target group of customers, retain them, and get the greatest return on the provision of services to them. After all, it is the customers who provide a significant part of the attracted liabilities, which allow the bank to carry out active operations, it is the customers who, by buying banking and non-banking products included in the banking ecosystem, give the bank the opportunity to make money on it.

Winning the fight for a client is not always determined by the price advantages of the service provided by the banks. Customers want to feel that the bank understands their situation and wants to help resolve it, considering their capabilities, and not to sell their product under the guise of customer care, without disclosing all the costs of purchasing a product and the risks associated with it. Despite the widespread opinion that customers choose a bank based on the lowest product price in the market, the reality is different. According to a study by the Boston Consulting Group (BCG), only 15–33% of the surveyed citizens in Europe, the USA, China, and Japan choose a bank based on its price parameter or consider it the most important (26% of clients of Russian banks do the same). At the same time, the bank's focus on meeting the needs of customers seems to customers more important, compared to the price, a characteristic that is decisive when choosing a bank for 43% of customers worldwide [1].

In this regard, it is advisable to analyze which non-price features of banks attract customers.

CORPORATE BANKING

Corporate customers appreciate that the customer service manager knows their industry and borrowing needs, has a deep understanding of the products on offer, and provide assistance beyond lending and transactional services. About 70% of commercial customers of North American banks believe that these qualities should be the main characteristics of customer service managers [2]. The customers will highly appreciate any efficient consultation of the bank on the activities of their companies, which is not directly related to the settlement and credit relations of the client with the bank, realizing that the bank collects information about their industry and business models of competitors, suppliers of raw materials and materials, as well as buyers of their finished products. The bank can help in organizing more efficient transactions of a customer with current suppliers and buyers of finished goods, not to mention expanding the range of such customer's counterparties from the bank's client base.

Therefore, the bank's significant advice related to the client's business is likely to be received with gratitude, as it will expand the customer's knowledge and capabilities in a key area for him.

An in-depth understanding of the industry and the needs of a customer working in it and his activity, which can be carried out on the basis of processing large volumes of data held by the bank and by third-party organizations, using advanced analytics, will allow the bank to predict services and banking products to meet customers' needs, to support and expand the volume of transactions with him. At the same time, a comprehensive analysis of the history of relations will most likely allow the bank to more adequately assess the risks associated with the customer, and significantly reduce provisions on them.

For example, if a bank sees that the company is actively developing, and it lacks collateral for the required loan amount for growing working capital, which is a serious obstacle for many, then instead of a temporary overdraft or an unsecured loan, a bank can offer factoring financing of receivables. It is secured by a pledge of the rights of a claim to a buyer of the company's finished products, which resolves the issue of increasing the customer's sales on favorable terms for the buyer of his products. This encourages the customer's client to buy even more goods from the bank customer and provides reliable bank risk coverage for this kind of lending that insurance companies perceive better than a risk of default

on the loan if they turn to them for insurance for such risks.

Or, if the company's financial situation becomes difficult, the bank initiates a restructuring of existing debt in accordance with a reasonable business plan, then the risks of non-repayment of debt are significantly reduced by channeling the funds generated by the company during the initial period of the loan to create additional value instead of diverting them to pay off the debt. Obviously, the bank's proactive approach will help to avoid getting a bad asset and create opportunities for customer revival.

The very fact of constant and expanded business support is often more significant for the customer than the price parameters of banking services since the advantages of such cooperation is much greater appreciated by companies than the price difference of different banks for the same financial products.

With the growth of operations in any company, especially in medium and large businesses, management of their own funds, domestic and international settlements become significant tasks. A bank may propose a company to transfer a part of the functions of the corporate treasury to it in order to increase their economic efficiency, which will certainly be of customers' interest since these are not essential for him in his business in terms of generating profits. Providing cash settlement services will help strengthen relationships with these corporate clients and generate additional commission income. This service is widely accepted by many banks in developed markets.

It is important for any customer to resolve the issues with which he applied as quickly as possible, and the minimum list of documents required by the bank for consideration. To respond to these challenges, the bank needs to significantly simplify its own procedures for handling customers' requests and improve the decision-making process (positive or negative).

The very fact of constant and expanded business support is often more significant for the customer than the price parameters of banking services since the advantages of such cooperation is much greater appreciated by companies than the price difference of different banks for the same financial products. Banks demonstrating such an approach may become long-term partners for companies.

RETAIL BANKING

The retail banking market, which accounts for about half of all banking industry revenues worldwide [3], is becoming as complex as corporate banking. Banks exert their best efforts to improve stability and deepen customer relations. However, customer expectations are growing at a faster pace than the growth in investment in attracting customers and strengthening relationships with them [4].

The convenience of using the bank's services, the availability of bank services anytime, anywhere from any device, which is achieved through multichannel communication between the bank and the client, is crucial for retail banking. This is not only about digital communication using interactive voice technologies such as voice assistants, answering machines, voice bots in call centers, or various types of screen information of the online and mobile banking systems. For retail customers, it is also important to have a human response to their requests, especially if it is not about reporting an event but consultations on the advantages of choosing a particular banking service or complex banking products.

Nowadays, when information about all banking products is available to customers without visiting the bank, the main factor attracting a client to the bank is considering by the bank the individual needs of the client, adjusting the existing banking product to the requirements and capabilities of the client. At the same time,

48% of consumers who consider themselves "good" customers also count on a special treatment [5], which means exclusive access to some services, special price offers, increased transaction limits, etc.

In order to receive personal banking services, customers are ready to share their personal information on a confidential basis, using it in the interests of the client and not distributing it without the client's permission. It is important for clients that the bank is willing to meet individual needs when they arise, for what they are willing to pay more than for service on standard terms. Moreover, customers expect the bank to be proactive in its offerings, i.e. will try to anticipate the needs of the client, resolve the customer's concern in a non-intrusive and timely manner. This approach of the bank to service is very important for the customer, who may view the bank as the main financial partner in addressing his vital challenges.

The growing loyalty of a retail customer to their bank depends on the quality of the bank's services, the speed and ease of transactions, the reliability of the bank, and the ability to process transactions over the long term. At the same time, only 30% of traditional banks worldwide satisfy customers with the quality of service and time savings, about 15% with simple transaction processing, and about 10% with the latter two value priorities [6].

The reluctance of banks to meet the needs of customers, as well as the increased awareness of the availability and quality of services in different banks, dramatically increase the willingness of retail customers to change their bank or, at best, to receive services in another bank at the same time.

Bain & Company notes a paradox in competition for retail banking customers. The stronger technology firms become and the wider the range of services they offer, the more customers are willing to buy such services, including banking products, from these firms. But when banks start the digital transformation, offering customers a service that is of the same quality as of technology firms, customers' loyalty to banks increases dramatically. Thus, in Belgium, France, Switzerland, the Netherlands, where banks actively master digital technologies, only 30% of customers are open to consider buying financial products from technology firms. At the same time, in India, China, Brazil, where banks underserve digitally and lag in digital basics, there are more than 80% of such customers [7].

It is not about how good technology firms are but about the lag in the digital basics of traditional banks, the unwillingness or inability to understand current trends of customer preferences. There is only one conclusion: banks need to make every effort to provide a competitive level of service, otherwise their customers will leave. Banks that cannot provide the level of service required by modern customers will cease to exist.

In general, confidence in banks remains high: 77% of respondents in the 2019 Accenture global consumer study said they trust their bank to take long-term care of their financial health [8]. This point is especially important because trust is a deep and decisive factor in determining the behavior of retail customers, which depends on how the above value priorities are met, while some differences in the price offers of banks, taking into account the risks that customers may see when comparing offers, are considered of secondary importance.

The price of banking services is significant, of course, but it should be considered that in the retail business, all banks offer approximately the same products. Accordingly, if you compete only on the price of a banking product or, for example, on the term of a loan on a credit card without charging interest during a certain period of time or on the amount of return of a part of the payment for a product or service (cashback), then as a result of such competition, in an extreme case, the price of a banking product may be lower of its cost, or the interest-free period will last forever, or the cashback will reach the goods or service purchase price. In any case, such competition does not make economic sense, and the rivalry in these exercises damages the entire banking industry. Moreover, if such competition is due to the fact that someone sees it as a struggle for

customer loyalty, then from the customer's point of view it will be unprofitable for the customer to show loyalty to his bank only on the basis of price preferences if some other bank offers more favorable price terms. Thus, the client is not against receiving benefits from the bank, however, if another bank offers more favorable conditions and this is his only advantage, then such a client will switch to another bank.

Therefore, banks are reorienting their approaches to clients. Cashback is gradually moving from a cash refund to the accrual of points, which can be converted into a limited range of real goods or services. The extended credit card interest-free period is more of a marketing ploy to attract customers in the hopes that they will use other banking products or go beyond the grace period, which will allow the bank to make a profit. Probably, the banks came to the conclusion (and the Central Bank of the Russian Federation, in particular, pushed them to this conclusion) that seducing retail customers with additional benefits so that they more use banking products is not effective in terms of generating profits. This manifested itself in January 2020 in a decrease in the number of issued credit cards. According to the Equifax Credit Bureau, for the first time in the last five years, they were issued 21.7% less, and the total limit on them decreased by 22.7%. In the fourth quarter of 2019, sales in this segment also fell — cumulatively by 11.4% in value, compared to the same period a year earlier [9].

Important non-price factors that determine the loyalty of bank customers, such as the quality of services, time savings, ease of transactions, and safety of funds, can be combined into one concept of convenience of using banking services. Customers' preference for convenience over price seems to be the driver of many successful companies not just banks. The most striking example is Apple, which sells probably the most expensive devices in its product categories (smartphones, tablets, laptops, wireless headphones). There is a massive demand for these products, which has provided this company with the highest capitalization in the world. It turned out that the high quality of products, various features added through the company's ecosystem, high-security level of hardware and software from hacking seem to consumers a sufficient added value which it is worth paying an increased price compared to similar devices for less money that do not provide such opportunities or provide them with lower quality. Hundreds of millions of people around the world have been demonstrating loyalty to Apple for years.

A similar situation is with banking services: the more convenience a bank can offer to its client with banking operations, and now with providing non-banking services, the more loyal the client will be, the more services he will buy in this bank and the more clients this bank will have, even if the cost of these services is higher than that of competitors. Just because consumers are willing to pay for convenience. Many customers choose convenience and quality over low cost and potential unexpected problems.

The bank's product range is significant, but the service for buying and using such products is of no less importance, i.e. the quality of a banking product is largely determined by the quality/convenience of its use by the customer, which indicates that banks need to ensure customer satisfaction with both the product and the process of its provision and consumption.

Thus, the commitment/loyalty of banking clients (corporate and retail) to a service provider arises largely due to the opportunity to use a banking service with the following value (non-price) characteristics:

- high quality of banking services;
- providing them when they are needed;
- predicting consumer needs for banking services;
- speed of transactions, minimum documents required, ease of communication with the bank;
- expertise outside the actual banking operations, which can help the client to improve his efficiency;
- cooperation with the client in those areas of work with funds that are not priority for the client in terms of generating profits, and the bank can increase their efficiency for him.

These characteristics are necessary but not sufficient without the customer's believe in the reliability of his bank and the possibility of long-term cooperation, which is critical when it comes to the money that the customer accumulates during his life.

DEVELOPING STRONGER RELATIONSHIPS WITH BANKING CUSTOMERS

Until recently, the function of cash settlements was performed only by banks, to which there was no alternative. Now there are technology firms, initially in non-banking sectors, that have started to use their technology to make it convenient for customers to consume not only their services but also part of traditional banking services, especially in the field of payments. Service users noticed that these firms actually perform banking operations more conveniently, efficiently, and cheaper than banks. The scale of activities of the largest technology firms is so great, they are so deeply embedded in everyday life, and cooperation with them is so convenient and effective that people began to trust them with their money. In the minds of many people, such firms are replacing traditional banks.

While the major banks today retain the trust of their customers, technology firms, such as PayPal and Amazon, are ranked by customers nearly as high as traditional banks for trust with their money. Additionally, younger customers, are more willing to buy financial products from technology firms than from banks [7].

In this regard, it is important to understand what loyalty means for banking customers. Is long-term loyalty to one bank a case of inertia, reflecting the view that there is little difference between banking providers? For instance, only 4% of SMEs in the UK switch bank each year for this reason [10].

It seems that we are now going through a period of changes in the perception of loyalty: in terms of relatively simple banking operations, which can be carried out by technology giants, FinTech players, and online banking providers, customers see the disadvantages of traditional banks, which are often slower and charge more commission. However, when it comes to complex banking products and comprehensive services, traditional banks outperform their new competitors. There are no signs that banks are willing to give some of their income to competitors. Most likely, they just need time to implement transformation to bring customers back.

One of the main problems in the banking industry for traditional banks is the problem of losing customers. However, customer migration may be hidden, as many may still have an account with their main bank and implement transactions on their accounts with other banks and technology firms at the same time. To meet this challenge, the bank needs to stop focusing only on the products it has to offer to its customers. The bank should become a customer-oriented organization with the understanding that a banking product is just a tool that helps attract customers and increase profitability. Since in most cases similar products are available from rival banks, the main competitive advantage of the bank should be quality customer service not the product itself.

The growing loyalty of a retail customer to their bank depends on the quality of the bank's services, the speed and ease of transactions, the reliability of the bank, and the ability to process transactions over the long term.

It is important to personalize banking services to meet the specific financial needs of the customer. Many banks boil it down to announcing that a "personal" manager is assigned to the customer, who in fact does not offer anything other than the standard banking programs, and only lists these programs and conditions, without having a right to amend anything in them for this customer.

Now personalization does not mean offering standard banking products but taking into ac-

count the specifics needs of the customer and his circumstances. Thus, if the offer is good and adjusted to the needs of the customer but he does not need it at the moment, it loses its relevance and the bank will not be able to sell it, i.e. bank's efforts were in vain.

The dialectic of investment in attracting new customers through investments in increasing the satisfaction of existing customers, who will then recommend their bank to their friends and acquaintances for free, becomes the most effective.

Customer expectations for a timely offer from a bank to address his needs come from customer experience with high-tech companies in the retail, travel, and hospitality industries that use advanced data, artificial intelligence, and other digital technologies to track and anticipate customer requests. They focus on the customers in real time to demonstrate they are following their specific interests.

In addition, personalization means that the bank's primary concern is to enable the customer to save money. In response to this attitude, which contrasts with the widespread feeling that the bank wants to do everything possible to ensure that the client spends as much of his money at the bank as possible, the customer will be willing to buy more different financial products.

Personalized service is necessary because, according to a study by Accenture, 71% of people believe that traditional loyalty programs, associated mainly with discounts, do not engender loyalty [11]. Customers looking for a lower price or a higher discount will immediately switch to another service provider if it makes a better offer. This does not mean that loyalty no longer matters. But today, as the correlation between customer loyalty and traditional buying behavior is weakening, it is becoming clear that the old rules of loyalty no longer work.

In the new paradigm, service providers must not only respond to customer requests but also closely monitor changes in his life, offer prompt and adequate services that a customer may need in changed circumstances. Customer information should no longer be limited to completed transactions and formal personal information that was previously provided by the customer. Using information from all available open sources, including ecosystem partners, and processing it using modern technologies, including predictive analytics, the bank will be able to offer a service that the client has not yet requested but already needs. To be relevant in its service, the bank needs as much personal information as possible, which is not always available from open sources. And more and more clients are ready to provide such information in exchange for two things: privileged personalized banking services and protection of such information from access by third parties without the consent of the information owner.

As a result, a new kind of competition is emerging between banks: for information about customers, since adequate information and the right methods of using it allow banks to make profits from it, selling their products as much and when the customer needs them.

It is clear that such cooperation is possible only if the customer trusts the bank with his personal data. In turn, the provision of truly personalized offers by the bank can lead to increased customer confidence.

Customers prefer digital channels of communication with the bank for ordinary transactions, but where problems need to be solved or complex transactions are required, the participation of bank employees is preferred. To ensure a customer-oriented approach of the bank, especially in corporate banking, it is undoubtedly important to attract and train highly qualified and motivated professionals who, actually, must do the above-mentioned work. Setting the right non-price reference points for managers, that should be converted into increased income from the customer, is a difficult task, primarily because the increase of income is an indirect result of the

work of such a manager. The manager needs to be focused on satisfying the interests of the customer as much as possible, and the customer must feel it. Only with this approach, the customer agrees to buy as many financial products as possible in the maximum possible volume. Not because the bank gives the best price offers but because the bank provides customer service with a deep understanding of the customer's needs, comprehensively and even outside the banking operations, leaving the customer more time and opportunities to run his own business and make a profit on it, or just saves his time.

In this context, it is interesting to analyze the balance of the bank's communication with clients through digital and human communication channels. With all the effectiveness of digital communications in terms of accessibility, there are a lot of problems with communication between customers and bank personnel on a number of issues for which it is impossible to write a right algorithm of answer. So, in the event of reporting a possible fraud with their accounts, about 90% of customers who called the call center were unsatisfied with the service, compared to 10% of dissatisfied customers who communicated with the department's specialists. With the size of the bank commission being discussed, the share of those dissatisfied with communicating with the call center reaches 80%. It is hardly worth ignoring the ineffective work of digital channels of communication since satisfied customers are 3 to 6 times more likely to recommend their bank compared to people dissatisfied with the bank's service, who are also 2–4 times more likely to switch to competing banks compared to satisfied customers [12].

Digital communication channels are still effective in routine banking, do not generate significant income [1], and are more focused on reducing costs, which is also very important. This circumstance also emphasizes the significance of maintaining and improving the network of bank branches, not only in terms of their geographical location but also in the creation of different types of branches from, possibly, completely digital to universal or created for specific operations. Highly qualified specialists of those branches could not only quickly and efficiently provide the services required by clients but also, taking into account communication with clients and understanding their capabilities and needs, as well as using the bank's database and in-depth analytics, where digital technologies are very useful, attract the attention of customers to other banking products and sell them, improving the bank's financial performance. Certainly, the cost of an operation in which a bank specialist is involved is higher for a bank compared to digital communication. However, digital channels do not replace human channels, they only relieve banking professionals from routine work in order to focus on more complex aspects of their activity and creation of additional income.

EFFECTS OF THE INCREASED CUSTOMER LOYALTY

Thus, the combination of digital functions and personalized approach with a new level of communication with customers opens up new opportunities for banks. According to BCG analysis, this development allows the average bank to increase operating profit by about 30% in five years due to the following factors:

- reshaping distribution and network (increase in revenue by 4% and reducing network costs by 8%);
- personalized service (increase in revenue by 6%),
- improving customer satisfaction by simplifying and speeding up operations and facilitating the interaction of customers with the bank (increase in revenue by 5% and reducing operating costs by 9%) [1].

Customer loyalty resulting from a change in the bank's approach to internal operations and customer service depends on improving the quality of the bank's services, the level of personalization, and the speed and simplicity of transactions. US banks with a highest non-price reference points had net interest income growth of 13% in 2014–2017, compared with 5% for banks which did not consider those reference points as a priority [6].

At the same time, it is necessary to note the importance of the emotional satisfaction of customers with the service received, and not only as a result of buying it at the lowest price. According to a survey by McKinsey & Company, 58% of respondents demand emotional satisfaction from taking into account their interests by service providers (exclusivity of services, priority of access to services, participation in experimental events), versus 42% who prefer only rational satisfaction in the form of a monetary reward [13].

The most advanced banks see customer service personalization as a set of measures covering the following areas:

- dynamic, targeted engagement with potential customers;
- personalized pricing and product offers;
- optimized multichannel journey and delivery;
- reduced customer churn through earlier identification and intervention.

The fact of personalized service is highly appreciated by customers not only in the form of emotional satisfaction but also in practical actions: 68% of respondents in the BCG global survey of retail banking said that they had deepened ties with their existing bank –– by purchasing additional products or service –– because of the bank's personalized approach. 41% respondents said that insufficiently personalized treatment was a factor in their decision to leave their bank [3].

It is advisable to focus loyalty programs not only on attracting new customers, which requires significant marketing budgets but also on retaining existing ones, for which exclusive programs and partnerships can be offered, allowing them to earn more (not at the expense of the bank but together with the bank). Programs for attracting new customers are interesting but often do not meet banks' expectations, and at the same time diminish the importance of actions on retaining existing customers [11]. The dialectic of investment in attracting new customers through investments in increasing the satisfaction of existing customers, who will then recommend their bank to their friends and acquaintances for free, becomes the most effective.

CONCLUSIONS

The aforementioned clearly demonstrates the importance of non-price factors in assessing customer preferences when receiving banking services.

It seems that the changed circumstances and facts indicate a new understanding of the phenomenon of customer loyalty in banking, the reasons for its occurrence, and development.

A proactive approach to customer service is based on a deeper understanding of customer needs, which can only be achieved through in-depth analytics of big data about customers and their preferences, as well as an efficient digital transformation of intrabank operations and communication with customers. However, it should be considered that in the end the customer loyalty is ensured by the bank staff. The support of modern technologies is important but bank employees play a significant role in customer loyalty.

Banks, that are able to meet customers' needs by using modern technologies, gain competitive advantages, and are rewarded with improved income and increased profits.

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The Impact of Digital Transformation on the Investment Potential of the Russian Cities

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ABSTRACT

The digital transformation of all socio-economic spheres of the country determines the inclusion of digital factors in the assessment of investment potential. The **aim** of this paper is to justify the need to include digital factors in assessing the investment potential and the assessment of the digital potential of St. Petersburg. The study includes statistical **methods** of correlation analysis, average values, comparison, and grouping. This paper defines the concept of digital potential; highlights indicators of digital technology development; presents a methodology and assessment of the digital capacity of St. Petersburg compared with other cities of federal status through 2016–2018. The author features three key components of digital potential: information and communication technology (ICT) infrastructure, digital government, and e-business. The study shows that St. Petersburg's digital potential is sustainably growing. The research reveals that the digital capacity of St. Petersburg is improving by boosting the "e-business" component which reflects the use of ERP and CRM systems by organizations, as well as by the e-commerce. The low level of the "digital government" component has a negative effect on the integral level of digital potential despite the ongoing digitization process in the public sector services. The **conclusions** of the study suggest that the use of digital channels to interact with public authorities, the digitization of businesses, as well as the implementation of electronic workflow processes will improve the digital potential of St. Petersburg. Taking digital factors into account as a part of the investment potential of a city will make it possible to accurately assess its investment attractiveness. The **findings** of the study may be useful to scientists, rating agencies, and government officials when making investment decisions. The **prospects** for future research on this topic consist of expanding its base, clarifying the components of the digital potential factors, and methods for assessing the investment attractiveness of a territorial entity.

Keywords: digital potential; investment potential; information and communication technology (ICT); digital economy; digital transformation; investment attractiveness

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INTRODUCTION

The growth of digital technologies has a significant impact on the investment potential of a city and its investment attractiveness. The society engagement in the digital economy in Russia ranks seventh among other countries.[1] Russia cities and regions of Russia, where technological and innovative projects are being implemented, have more opportunities for increasing economic and investment activity, as well as for attracting business. At the same time, investments play an important role in the introduction and development of digital technologies, and their implementation at different stages of the investment process is the key to the country's economic growth.

The Russian Digital Economy program is being implemented within the framework of the state policy to create the necessary conditions for the development of information and communication technologies (ICT). The program is aimed at creating an ecosystem of digital economy in Russia, where digital data is a key factor in all spheres of socio-economic activity for effective interaction between business, the scientific and educational community, the state, and the citizens.[2] According to the roadmap of the program, state measures are designed until 2024. Thus, the constituent entities of Russia, which have been actively implementing the Digital Economy program since 2017, are involved in digital transformation processes, which, in turn, affect investment attractiveness, forming a new component. The impact of the digital economy on the investment attractiveness of Russian cities has significantly increased over the past five years, which makes it relevant and necessary to develop a methodology for assessing digital capacity, including digital factors of investment capacity for an integrated investment attractiveness assessment.

ANALYSIS OF APPROACHES TO ASSESSMENT

There are several studies devoted to the methodology and assessment of the investment attractiveness of a territorial entity (city, region, country), its relationship with investment capacity and investment risk, the impact on the investment activity of domestic and foreign investors[3] [1–3]. Russian and foreign academic communities, international organizations, credit rating agencies are engaged in the assessment of investment attractiveness. Most scientists agree that investment attractiveness should be considered as a set of objective development factors that affect the investment decision-making process and, therefore, determine the level of capital inflow: "Investment attractiveness is a system of various factors that form the intensity of attracting fixed assets investment" [4]. In most studies of the investment attractiveness of Russian regions, these factors are divided into two types: factors of investment potential and investment risk. At the same time, the investment potential in its content is interpreted as the ability of a subject to satisfy the need for investment resources without attracting borrowed funds, considering the available factors of production [5–7]. A distinctive feature of the investment potential is a consequence of the economic growth of the subject: "the investment capacity is the totality of all the resources of the subject, which provide steady growth of the main economic indicators as a result of their use" [8].

The practical significance of assessing investment attractiveness is ensured by ranking the investment climate characteristics within

[1] Based on the materials of the international industrial forum Innoprom. Industry 4.0. The new stage of the industrial revolution in Russia. URL: https://bfmspb.ru/novosti/industriya-4.0-novyij-etap-razvitiya-promyishlennoj-revolyuczii-v-rossii (accessed on 10.07.2020).

[2] Russian Digital Economy state program. Approved by Government decree No 1632-p of July 28, 2017. URL: http://static.government.ru/media/files/9gFM4FHj4PsB 79I5v7yLVuPgu4bvR 7M0.pdf (accessed on 14.07.2020).

[3] Investment climate of Russian regions: assessment experience and ways of improvement. Moscow: Institute of Economics RAS; 1997. 351 p.

the country (by regions of Russia) or within other countries. In most cases, the investment climate characteristic of the region implies the assessment of investment attractiveness, with the investment capacity being one of its components.

According to the methodology of the well-known credit rating agency Expert RA "the investment capacity is a quantitative characteristic that takes into account how saturated the region is with production factors (natural resources, labor, fixed assets, infrastructure), consumer demand and other indicators affecting the investment potential of the region".[4]

In the popular methodology of the Council of Productive Forces, the regional investment capacity is referred to as "a set of objective economic, social, natural-geographical and other properties of the region that are significant for attracting investment" [9].

Foreign approaches to assessing investment attractiveness are similar to domestic ones. In the World Bank's Investment Climate World Development Report, investment capacity is considered as a set of local factors that determine the ability and incentives of companies to invest in production, create jobs and expand activity.[5]

The methodology for assessing regional investment risks, developed by the Institute for Advanced Studies, IAS in 1995 on request of the Bank of Austria, defines investment capacity as a quantitative characteristic that depends on various factors: economic, social and cultural, innovative, legislative, infrastructural, institutional, environmental [10].

In the Global Foreign Direct Investment Country Attractiveness Index, the investment potential is assessed by identifying proxy indicators that determine a country for investment: macroeconomic and political stability, financial structure, business environment[6] [11]. At the same time, in foreign and Russian studies devoted to the assessment of investment attractiveness, it is often noted that a favorable combination of indicators of investment potential created conditions for increasing investment activity in the region, and, hence, improving the living standards of the population and economic growth. Thus, we are confident that the investment potential is a combination of various factors of regional development that affect the investment processes of a territorial entity.

Factors of investment capacity are usually classified according to the areas of their occurrence: financial, economic, production, labor, consumer, infrastructural, institutional, innovation, natural resources, tourism. At the same time, the composition of indicators characterizing the factors of investment capacity may vary. For example, in the monograph by V.V. Litvinova labor potential is assessed by three indicators [12]. E.G. Chachina described five particular indicators in her dissertation [3]. In the work of another group of researchers, there is no single indicator characterizing the labor factors of investment potential [9]. It is important to note that most of the methods were developed at the end of the twentieth century, therefore, it is necessary to update the composition of indicators in assessing the investment capacity. In particular, the development of digital technologies in the field of the industrial Internet, digital design, high technologies, public services, etc. leads to the digital transformation that affects all sectors of the economy and the process of attracting investment. Hence, digital factors need to be added to investment potential.

[4] The methodology for compiling the rating of investment attractiveness of Russian regions by "RAEKS-Analytics". 2017. URL: https://raex-a.ru/update_files/3_13_method_region.pdf (accessed on 13.08.2020).

[5] World development report 2005: A better investment climate for everyone. Washington, DC: The World Bank; 2005. 290 p. URL: http://documents1.worldbank.org/curated/en/554071468182337250/pdf/288290WDR 00PUB 0r0investment-0climate.pdf (accessed on 13.07.2020).

[6] According to DHAMAN methodology. Source: Methodology of the Arab Investment and Export Guarantee Corporation (DHAMAN). URL: http://www.fdiattractiveness.com/index-methodology/ (accessed on 12.07.2020).

DIGITAL POTENTIAL AS A FACTOR OF INVESTMENT ACTIVITY

A study of the impact of digitalization on investment activity, taking into account global economic processes, conducted by A. Yu. Fadeeva shows a close relationship between the level of development of information and communication technologies of countries — ranked high in digitalization and business environment (Doing Business report), investment potential (Rating of countries with the greatest investment potential BERI), as well as investment attractiveness (Foreign Direct Investment Confidence Index) [13]. A high level of ICT development is a key driver in increasing investment, which has a positive effect on the country's GDP, optimizes government spending, and reduces unemployment. A 1% increase in digital transformation investment leads to a 0.5% growth in GDP and 1.9% in international trade, according to research by consulting agency Accenture.[7] The study also notes that the transfer of public services to a digital platform reduces the cost of public administration by 25–45%. In addition, research materials by foreign scientists indicate that today the impact of ICT on the macroeconomic indicators of countries is not fully taken into account. Thus, according to the latest study by a group of US scientists led by Kevin Fox, the cost of digital social media platforms (Facebook, Twitter, Pinterest, etc.) is equivalent to 0.11% of US GDP, and if the platform's activity had been considered in 2003–2017, the average annual growth rate of the country's GDP would have increased from 1.83 to 1.91% [14].

As for studies devoted to assessing the digital potential of a territorial entity (city, region, country), they are currently none. There are statistical data characterizing the processes of social and business digitalization, as well as studies by Russian scientists devoted to the analysis of trends in various sectors of the Russian economy, indicating the processes of digitalization [15, 16]. The issues of the global impact of the digitalization process on the activities of transnational and technological corporations are considered. It has been proved that digital assets of IT companies should be considered as a separate economic unit that determines the company's capitalization, regardless of the provisions of international investment law, the essential prerequisites for changing which are determined by the scale of the ongoing changes in the technological sphere of developed economies [17].

Recently, the studies have been published on the analysis and assessment of the digital potential of Russian companies, which reflect the view of Russian scientists on the digital potential of an enterprise. In the work of N.V. Gorodnova, D.L. Skipin, A.A. Peshkova [18], it is considered as a unity of three components:

1) resources;
2) internal capacity of the company to implement certain stages of the IT development;
3) functional areas of activity where information technology can be applied.

In the study by A.V. Kozlova, A.B. Teslya [19] the digital potential of an industrial enterprise is defined as an integral indicator reflecting the current level and future opportunities of using digital technologies by an enterprise, factoring in environmental conditions.

Considering the aforementioned, in the next section of the paper the concept of digital capacity is defined; indicators characterizing the development of digital technologies are identified; a methodology was developed and an assessment of the digital capacity of St. Petersburg was carried out in comparison with other cities of federal significance for the period 2016–2018.

[7] Digital technologies at the heart of public service transformation and as a catalyst for economic growth and innovation. Accenture. Report. 2017. URL: https://www.accenture.com/t20150523T033713__w__/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub_9/Accenture-Digital-at-Depthfor-Government-Innovation.pdf (accessed on 13.07.2020).

METHODOLOGY AND RESULTS OF DIGITAL CAPACITY ASSESSMENT

Digital capacity is a collection of information and communication technologies that improve the quality of investment decisions and increase investment opportunities. To assess the impact of digital transformation factors on the investment potential of St. Petersburg, the structure of digital potential can be represented as a unity of three components: ICT infrastructure and access, digital government, and e-business (*Fig. 1*).

The "ICT — infrastructure and access" component refers to the level of development of communication and data transmission networks, the use of the Internet, the effectiveness of R&D, the development of the information industry, and the level of information security. Since the development of information and communication technologies plays a key role in the economy, and also stimulates economic growth by increasing the level and quality of services available, the assessment of this component is relevant.

The second component of digital potential is the "digital government". Digital government services simplify access to public services and improve the quality of their implementation. The ability to interact with public authorities in digital format is seen as a prerequisite for increasing investment activity. Within the framework of this study, the "digital government" component is an integral indicator that assesses the level of readiness and capabilities of government agencies to use ICT, as well as the level of use of digital public services by the population.

The third component that can be used to assess the level of digital potential of the city is "e-business". This is a promising direction for doing business, which increases the level of investment attractiveness and competitiveness of the city. E-business is defined as a system of the following factors:

- integration of internal IT systems and general access to the data within the organization;
- integration of the organization's IT system with the third party's IT system and e-commerce.

To assess the three components of digital potential, statistical data were used that characterize the level of development of each component (particular factors). The source of information is the data of the Federal State Statistics Service of the Russian Federation and the Federal Service Office for St. Petersburg and the Leningrad Region. The composition and values of the components of digital potential for 2018 are given in *Table. 1*.

The assessment of the integral (overall) level of digital potential occurs in the following sequence: at the first stage, statistical indicators are selected that characterize the level of digital transformation of a city (specific indicators of digital capacity). Specific indicators are grouped into three components.

During the second stage, the significance of the selected indicators of digital potential is confirmed by the degree of their influence on investment activity using the method of correlation analysis.

During the third stage, the values of specific indicators of digital potential are standardized, for which other cities of federal significance are included in the assessment and arithmetic mean values are calculated for each particular factor of digital potential. Further, the integral level of digital potential is estimated using the formula of the multivariate mean.

To assess the digital potential of St. Petersburg, the data were used for the period from 2012 to 2018. To substantiate the significance of the selected factors of digital potential, the Pearson pair correlation coefficient was calculated, which characterizes the close relationship between the indicators. The significance of the linear correlation coefficient was confirmed by *t*-staticstics. At the same time, the volume of investments in fixed assets of St. Petersburg was used as a resultant indicator characterizing investment activity. Correlation analysis showed close relationship between fifteen out of nineteen specific indicators of digital

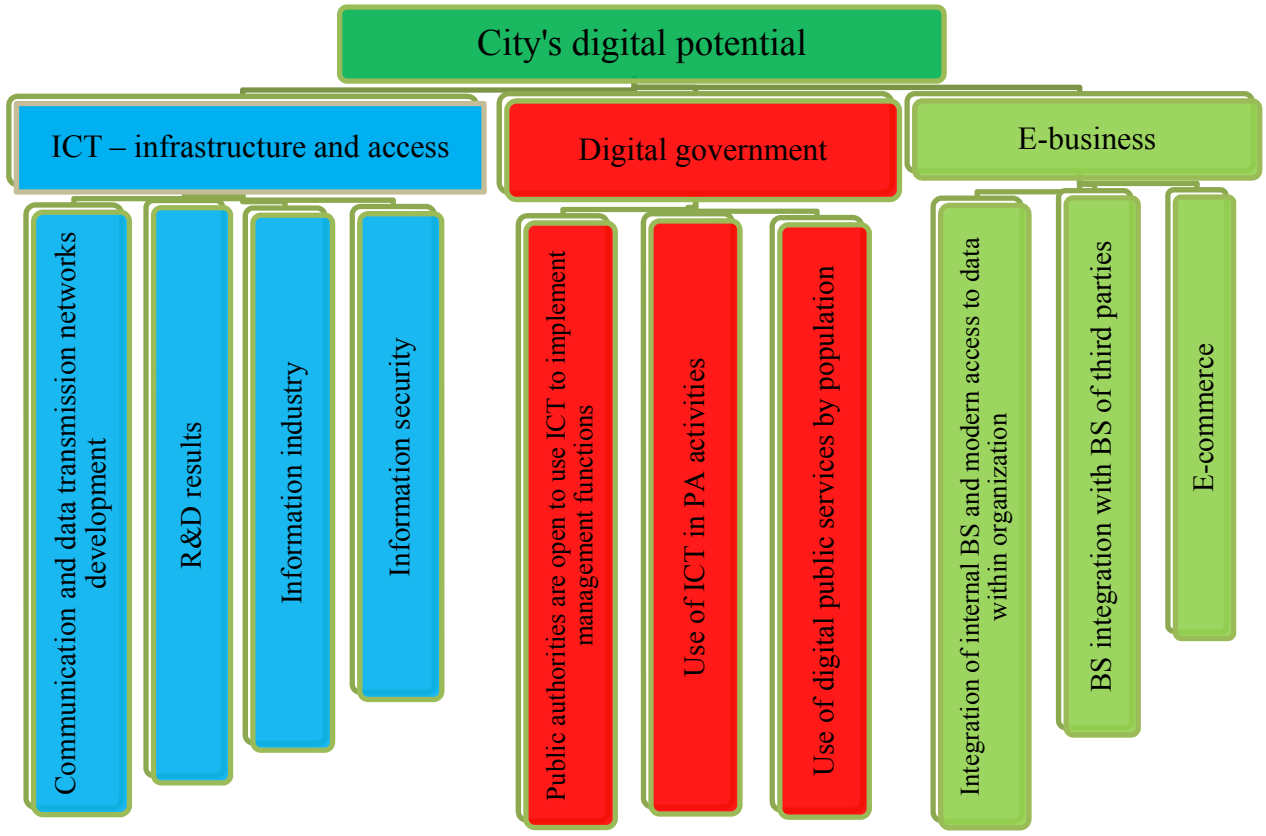

Fig. 1. **City's digital potential structure**

Source: compiled by the author.

Note: ICT — information and communication technology, PA — public authorities, BS — business system.

potential, which were further included in the assessment.

This confirmed the hypothesis of the study about the strong influence of digital potential on investment activity. Therefore, it is necessary to take into account digital factors in the composition of investment attractiveness.

Based on the values of the correlation coefficients, the following indicators have the greatest influence on investment activity in the city:

- digitalization level of the local telephone network (0.96);
- share of organizations using ERP systems (0.93);
- mobile broadband internet users per 100 people (0.91).

Three factors of innovative potential with a correlation coefficient of less than 0.2 were excluded from the study.

At the next step, standardized values of digital potential factors were calculated using specific indicators characterizing the digital transformation of two other cities with federal status — Moscow and Sevastopol (*Table 2*).

To assess the integral level of digital capacity, the values of specific indicators were integrated according to the formula of the multivariate mean:

$$M_i = \frac{\sum_{n=1}^{m} k_n \frac{Pni}{\overline{Pn}}}{\sum_{n=1}^{m} k_n} \quad (1)$$

where M_i — the integral value of the city's investment potential level, comparable with the average level of the value for the cities with federal status, taken as 1.00; $i = 1,\ldots, k$ — total number of cities under study; m — specific

Table 1

Specific factors (indicators) of the city's digital potential in 2018

Component	Indicators	Name of variable	Value 2018	
			St. Petersburg	Russia
ICT — infrastructure and access	Digitalization level of the local telephone network, %	X_{u1}	82	94
	Fixed broadband internet users per 100 people	X_{u2}	29.3	21.7
	Mobile broadband internet users per 100 people	X_{u3}	108.2	86.2
	Fixed assets investment used to purchase information, computer and telecommunication equipment, million rubles	X_{u4}	26 514	484 035
	Share of Internet users in the total population	X_{u5}	0.93	0.87
	Share of ICT sector employees in the total employed population, %	X_{u6}	3	1.6
	The share of organizations that used tools for protecting data transmitted over global networks — encryption, electronic signature, digital signature	X_{u7}	0.844	0.893
	Share of the population not using Internet for security reasons, %	X_{u8}	0.3	0.4
	Share of organizations implementing technological innovations in the total number of surveyed organizations	X_{u9}	0.37	0.20
Digital government	The share of the population using the Internet to receive public and municipal services in the total population that received the services, %	X_{u10}	69.9	74.8
	Share of electronic document flow between public authorities	X_{u11}	0.506	0.501
	Share of the population using the Internet to receive public and municipal services	X_{u12}	0.44	0.45
E-business	Share of organizations using ERP systems, %	X_{u13}	19.5	13.8
	Share of organizations using CRM systems, %	X_{u14}	17.9	13.2
	Share of organizations using electronic document management systems, %	X_{u15}	68.5	68.6
	Share of organizations using electronic data exchange with external information systems via exchange formats, %	X_{u16}	73.7	64.9
	Share of organizations using SCM systems in the total number of surveyed organizations, %	X_{u17}	5.7	6.4
	The share of organizations that placed orders for goods (works, services) via the Internet	X_{u18}	0.49	0.42
	The share of organizations that received orders for goods (works, services) via the Internet	X_{u19}	0.317	0.225

Source: compiled by the author based on the Federal State Statistics Service.

Table 2

Normalized/ Standards values of specific indicators in 2018

Specific indicators of digital capacity	Cities with federal status		
	St. Petersburg	Moscow	Sevastopol
$X_{ц1}$	0.904	1.092	1.004
$X_{ц2}$	1.338	1.404	0.257
$X_{ц3}$	1.422	1.539	0.038
$X_{ц4}$	1.279	1.710	0.011
$X_{ц5}$	1.084	1.084	0.831
…	…	…	…
$X_{ц15}$	1.154	1.143	0.703
Хц	1.08	1.19	0.70

Source: the author's calculations.

indicators; P_m — numerical value of *n* indicator for *i* — city; $\overline{Pn}$ — numerical value of *n* on average in cities with federal status; *Kn* — the total set of all integrable specific indicators for this factor.

The table shows the results of calculating the integral level of the digital capacity of St. Petersburg for 2016–2018 (*Table 3*).

According to the *Table. 3*, the components "ICT infrastructure" and "E– business" in St. Petersburg are at a high level. This suggests that the city has a highly developed level of digital activity. Thus, the indicator of the value of fixed broadband access per 100 people in 2018 in St. Petersburg is 29.3 of all households, in Moscow — 36, in Sevastopol — 6.6, with an average level in Russia of 21.7 (*Fig. 2*). It should be noted that the growth of fixed broadband Internet access is significantly lower than mobile access due to the possibility of being mobile and always connected for users. However, the high level of these indicators influenced the value of the ICT infrastructure component, as they complement each other.

The level of digitalization of the telephone network in St. Petersburg is growing every year and as of 2018 is 81.8%. The level of digitalization of the telephone network is closely related to the possibility of using high-speed Internet (*Fig. 2*).

The level of the "E-business" component was significantly influenced by the high values of the e-commerce indicator — 49% of the total level of digitalization in 2018, while the average indicator for Russia is 42%.[8] In addition, its level depends on the level of intranet (integration of IT systems within organizations) and extranet (integration of IT systems with third parties) use. Generally, in terms of the level of intra- and extranet development, St. Petersburg scores higher the average across Russia but lower than Moscow. The share of organizations using ERP and CRM in Moscow, on average for the period from 2016 to 2018, is, respectively, 21.5 and 19.5%, while in St. Petersburg this indicator is lower — 19.5 and 17%. The share of organizations using electronic data exchange between their own and external systems on average in Russia, in 2018 — 64.9%, in Moscow — 78.2%, in St. Petersburg — 73.7%.

The "Digital government" component is in the third place. This is due to the lower values of indicators in the composition of the component in comparison with Moscow and indicators of other components of digital potential. For example, the share of the population who received public services in St. Petersburg in the period

[8] Hereinafter — by the Federal State Statistics Service. URL: https://rosstat.gov.ru/folder/14478?print=1 (accessed on 10.08.2020).

Table 3

Integrity level of the digital potential

Period	ICT infrastructure	Digital government	E-business	Integrity level of the digital capacity
St. Petersburg				
2018	1.15	0.94	1.16	1.08
2017	1.13	0.93	1.15	1.07
2016	1.13	0.91	1.10	1.05
Moscow				
2018	1.35	1.22	1.17	1.25
2017	1.35	1.26	1.16	1.26
2016	1.33	1.21	1.17	1.24
Sevastopol				
2018	0.49	0.87	0.72	0.69
2017	0.47	0.85	0.65	0.66
2016	0.38	0.81	0.59	0.59

Source: the author's calculations.

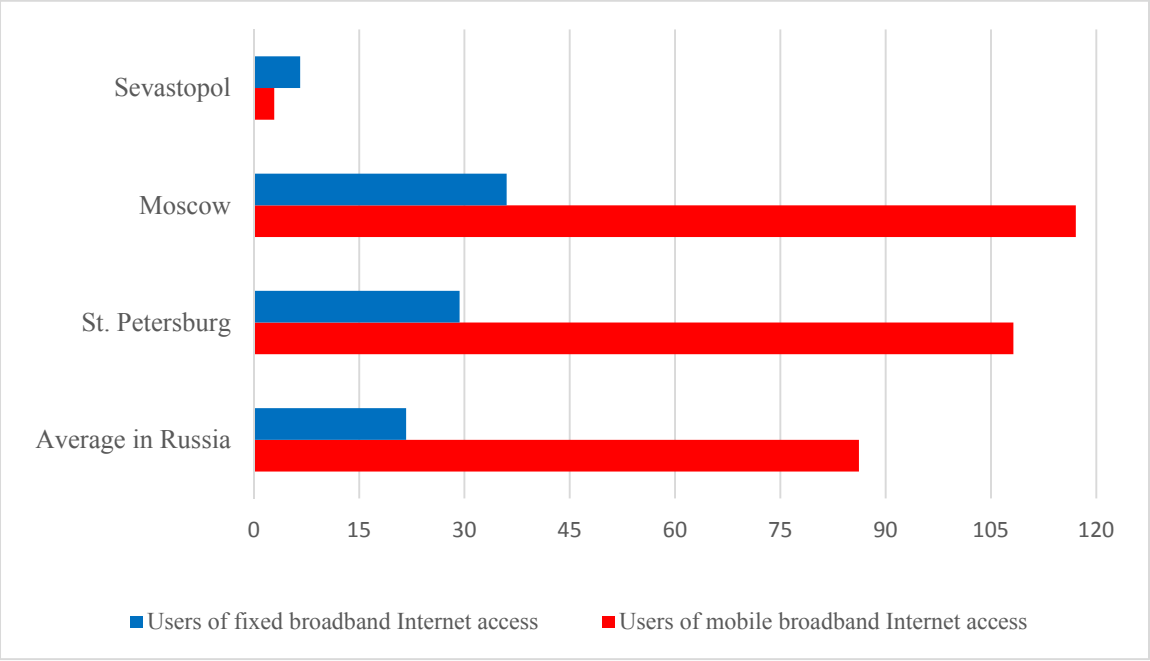

Fig. 2. **Internet users per 100 people**

Source: compiled by the author based on the Federal State Statistics Service. URL: https://rosstat.gov.ru/folder/14478?print=1 (accessed on 10.08.2020).

from 2016 to 2018 is 58.6; 69.9; 77.5%, respectively, versus 71.3; 80; 83.2% of the values of similar indicators in Moscow. At the same time, the possibility of using electronic document management systems, the Digital government service, together with the investment portal in St. Petersburg, contribute to reaching the full investment potential of the city.

CONCLUSIONS

Digital transformation is an integral part of the changes taking place in all the countries of the world. The impact of digitalization on the economy and investment attractiveness of the Russian cities in recent years has significantly increased and, obviously, will continue growing, as the introduction of information and communication technologies in various areas is one of the priorities of the state policy in Russia. For an objective ranking of the Russian cities by the level of investment capacity and the impact of digitalization on investment activity, it is necessary to consider digital factors as part of the investment attractiveness, which are grouped into three categories: information and communication infrastructure, digital government, and e-business. When developing a methodology for assessing the digital potential of territorial entities, it is important to use correlation analysis to substantiate the influence of the selected statistical indicators, considered in the capacity composition, on the level of fixed assets investment. At the same time, the methodology itself can be based on previously developed algorithms used by theorists and practitioners to assess the level of investment attractiveness of the Russian cities.

The assessment of the digital potential of the Russian cities allows us to conclude that St. Petersburg has been showing moderate growth in the digital capacity over the past three years. The city predictably ranked second on digital potential, and the first place was kept by the capital of Russia. This is the expected result. Moscow is leading in terms of ICT implementation in the urban environment and its use by the population, which is reflected in the higher value of all the digital potential components.

Sevastopol, the capital of the Crimean federal district, which joined Russia in 2014, is in the third place. The digital transformation indicators of Sevastopol are significantly inferior to those of Moscow, St. Petersburg, and the average values for the regions of the Russian Federation. For example, the level of mobile Internet use by the population in 2018 is ten times lower than in Moscow and on average in cities of the Russian Federation. This difference of indicators led to a significant decrease in the level of a comprehensive assessment of the "ICT infrastructure" component and, as a result, to a low level of the digital potential of Sevastopol.

The decrease in the integral level of the digital potential of St. Petersburg was influenced by the "Digital government" component, which shows the lower level of use of electronic public services by the population compared to other cities with federal status, despite the ongoing digitalization processes in these services. Thus, a promising area that contributes to increasing the digital potential of St. Petersburg is the use of digital channels of interaction with authorities, the integration of IT systems within organizations, as well as the active use of electronic document management systems.

In conclusion, it should be noted that the obtained results are divided into two blocks: on the one hand, a methodology for assessing the digital potential of the Russian cities in the economy is proposed, its approbation is carried out, and the received results reflect the differences of cities in terms of the level of use of digital technologies. On the other hand, the necessity of including digital potential in the assessment of investment attractiveness has been substantiated. The development of the methodology for assessing investment attractiveness, taking into account digital factors as part of the investment potential, will consider the impact of digital

transformation on the socio-economic growth of regions of the Russian Federation, as well as receive updated investment attractiveness rating of regions. The materials presented in the article may be useful to Russian and foreign scientists; credit rating agencies; civil servants. Future studies on the current topic should focus on clarifying the specifc indicators of digital potential, expanding the research base (assessing the investment potential by the federal districts of the Russian Federation), clarifying the methodology for assessing the investment attractiveness of a territorial entity.

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Institutional Features of the Development of Competitive Cryptocurrency

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ABSTRACT

The **aim** of the article is to clarify the basics of the digitalization strategy of the competitive businesses and identify features of the institutional environment that ensure the development of cryptocurrency as a new asset (IT product) of the modern economy, analyze the methods of implementing the cryptocurrency business models. The **relevance** of the research paper is determined by the need to develop a competitive Russian cryptocurrency (including the crypto-ruble) with the growing private, state and cross-national cryptocurrencies. The **scientific novelty** of the study implies clarifying the informal and formal rules of the institutional environment and related methods ensuring the development of a competitive cryptocurrency. The authors consider the following **methods** to implement the institutional features of the cryptocurrencies business model development: logic and blockchain algorithm that establish trust and collaboration between cryptocurrency developers; logic and blockchain consensus algorithm ensuring that all the parties of the blockchain network come to a common agreement (consensus); logic and blockchain algorithms that form cryptocurrency transactions and control its turnover by generating blocks of cryptocurrencies, by forming the structure of blocks and transactions of cryptocurrencies, by storing cryptocurrencies' keys and providing security, by mining (forging) cryptocurrency, etc. The **results** of the study provide a basis for identifying the institutional features and the corresponding methods providing a competitive cryptocurrency development with a detailed analysis of the blockchain consensus algorithms that ensure the competitiveness of the cryptocurrency. The **conclusions** show that the most promising are the hybrid consensus algorithms which may include both the logic of two or more known algorithms and the original logic of a new algorithm. The authors **recommend** defining the logic of the blockchain consensus algorithm as a priority when developing a cryptocurrency to ensure reliability of the transactions in the blockchain network, thus increasing the competitiveness of the cryptocurrency.

Keywords: institutional environment; formal and informal rules of the institutional environment; competition; cryptocurrency; business model; blockchain; logic; algorithm; consensus

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INTRODUCTION

The first cryptocurrency Bitcoin started in 2009 on the basis of the blockchain algorithm developed by Satoshi Nakamoto [1], which implemented the thesis about the freedom of the creative person in the information society from the government intervention and its regulators [2]. This idea was introduced by cypherpunks[1] and crypto-anarchists in the 1990s last century [3, 4], but, as shown by P.I. Talerov [5], it is closely connected with the discussions of the 19th and 20th centuries about the importance of the market competition between anarchists and economists. Interestingly, the discussion resulted in a theory put forward by the Russian anarchist P.A. Kropotkin, which was accepted by the scientific community, that except for Darwinian competition, there is another fundamental law — mutual aid [6].

The development of digital financial assets changed the international world of finance [7] and triggered the onset of the era of cryptocurrencies [8]. The studies of the cryptocurrency features have identified them as a new financial asset [9].

With the massive emergence of private [10–12], state-run (Japan,[2] China,[3,4]) and shared (within the BRICS,[5,6]) cryptocurrencies and the active digital transformation of the Russian society[7] the issue of developing a Russian competitive cryptocurrency, for example, a crypto-ruble, is on the agenda [13, 14]. The analysis of the problem showed that it is necessary to identify the features of the institutional environment that form the cryptocurrency as a competitive asset of the digital economy and to determine the methods of their implementation in order to solve it.

COMPETITION AND COMPETITIVENESS OF IT PRODUCTS

The contemporary encyclopedia gives the following definition of competition: "... competition (from *Late Lat. concurentia, concurrere — to collide*), rivalry, a contest between people, groups, organizations for achieving similar goals, the best results in a particular social sphere. Competition is an essential feature of various types of activity where there is a clash of interests (politics, economics, science, sports, etc.)".[8]

In the monograph by E.V. Drobot it is noted that "... competition is one of the main characteristics of the market economy. The competition obliges a socially and legally free person to creative activity, creates conditions for personal fulfillment in the economic sphere in the form of developing new competitive goods and services" [15].

An integral part of the competition is the competitiveness of products, defined as "... the property of products to be attractive in comparison to other products of a similar type and purpose by better matching the requirements of a particular market and consumer evaluations. ... The characteristics of a product determine its consumer attributes, which, in turn, includes some quality indicators of this product. The competitiveness

[1] May T.C. The Crypto Anarchist Manifesto. Nov. 92. URL: https://www.activism.net/cypherpunk/crypto-anarchy.html (accessed on 15.05.2020).

[2] Cryptocurrency is recognized as a method of payment in Japan. URL: http://tass.ru/ekonomika/4144338 (accessed on 15.05.2020).

[3] Dorenkov I. Chinese authorities facilitate the launch of the digital yuan. URL: https://news.crypto.pro/vlasti-kitaja-forsirujut-zapusk-cifrovogo-juanja/ (accessed on 15.05.2020).

[4] Baloyan S. China launches state cryptocurrency: how it could change the financial world. URL: https://vc.ru/finance/122749-kitay-zapuskaet-gosudarstvennuyu-kriptovalyutu-kak-eto-mozhet-izmenit-finansovyy-mir (accessed on 15.05.2020).

[5] Goncharov A.I., Goncharova M.V. Digital Tokens in the Tools of Modern Foreign Trade Activities by Economic Entities of the BRICS Jurisdictions. Legal Concept. 2019;18(3):31–42. DOI: 10.15688/lc.jvolsu.2019.3.5

[6] Grigoryeva Y. BRICS Token: New Wave in International Payment System. URL: http://infobrics.org/post/30179/ (accessed on 15.05.2020).

[7] Digital Russia Report. Digital McKinsey. URL: https://www.mckinsey.com/ru/~/media/ McKinsey/Locations/Europe%20and%20Middle%20East/Russia/Our%20Insights/Digital%20Russia/Digital-Russia-report.ashx (accessed on 15.05.2020).

[8] Competition. Modern encyclopedia. URL: http://www.вокабула.рф/энциклопедии/современный-энциклопедический-словарь/конкуренция (accessed on 15.05.2020).

of a product depends both on a separate indicator and on their combination (synergy). The competitiveness of the product is ensured by the competitive positions occupied by the enterprises that produce and distribute the product. The indicators characterizing the competitiveness of the product <...> are a combination of "hard" and "soft" indicators <...>. "Hard" indicators provide the physical possibility of using goods for their intended purpose and are subdivided into the following groups: technical <...>, ergonomic <...>, technological <...>, and normative <...>. "Soft" indicators characterize the aesthetic <...> and psychological <...> characteristics of the product".[9]

Considering the definition of the competitiveness of products, the competitiveness of the cryptocurrency will be defined as follows.

Firstly, a competitive cryptocurrency should have a new consumer attribute that forms, in contrast to existing cryptocurrencies, its useful effect. As will be shown below, this attribute is ensured by the application of specific "hard" and "soft" rules of the institutional environment in which it was developed.

Secondly, a cryptocurrency should have characteristics that make it competitive among other cryptocurrencies. However, as shown in [16, 17], the market aspect of competitiveness of the cryptocurrency requires to study the rules for the functioning of the institutional environment of the crypto market as a whole, therefore, is not considered in this paper.

Research has shown that in practice two principles of developing competitive products may be used: systemic and process-based [18, 19]. In the first case, there is a competitive environment [20] that promotes product development. In the second case, the market-based [21] and inter-company processes [22] or inter-organizational structures [23, 24] are formed, contributing to the same process. Moreover, in the work of Yu. V. Taranukha showed that the development of economic relations in modern conditions leads to the evolution and modification of these principles [25].

The development of a competitive IT product was analyzed in the work of N. M. Rozanova and I. V. Lineva [26]. The authors argue that "... a competitive IT product is a modern business tool for transforming a traditional business model into a digital model". The authors note that "... an important aspect of the competitiveness of an IT product remains the same: what to produce and according to what formalized requirements?" Based on these assumptions, the authors summarize that "... a competitive IT product is a tool of modern business for transforming a traditional business model into a digital model", or, moreover, "... a competitive IT product is a digital model of a modern company using its key components: mobile devices, big data, cloud platforms".

To identify the rules (informal and formal) required to create such a competitive IT product as a cryptocurrency, we will consider the structure and composition of the institutional environment and methods that contribute to solving this problem.

RULES OF THE INSTITUTIONAL ENVIRONMENT, DEFINING PRACTICES AND DEVELOPMENT METHODS OF COMPETITIVE CRYPTOCURRENCY

There is a small bibliography on the institutional environment formation contributing to the development of competitive products. So, in the work of R. R. Nureeva and her colleagues [27], this issue is solely investigated at the macro level. In the work of I. A. Ivanenko and F. N. Saifidinova [28], the study of the institutional environment is associated with assessments of the instability of the economy arising in the competitive

[9] Competitiveness of products. Wikipedia. URL: https://ru.wikipedia.org/wiki/Конкурентоспособность_товара (accessed on 25.05.2020).

market environment. The most in-depth research on the formation of the institutional environment under competition is given in the monograph by A. Kh. Khakimov [29]. The author examines the influence of the institutional environment on the competitiveness management of enterprises in the context of the integration processes in the market. A. F. Grishkov in his work [30] substantiates that enterprises should develop and use software and hardware for dynamic monitoring and adjustment of competitiveness factors to manage competitiveness in a complex institutional environment.

The works by D. E. Sorokin [31, 32] show that the formation of the institutional environment of modern Russian society is significantly influenced not only by formal but also informal rules and practices. When developing cryptocurrencies, the significance of this idea is confirmed by the facts of using various rules and practices by venture entrepreneurs [33], representatives of different types of enterprises [34], and developers of digital platforms [35].

It was shown above that the characteristics of the competitiveness of any product are a set of "hard" and "soft" indicators. Let us define an appropriate set of "hard" and "soft" rules of the institutional environment and methods of their implementation.

In the study, we will proceed from the assumption that the "hard" indicators should ensure the physical possibility of using the product for its intended purpose. Then the "hard" rules of the institutional environment, first of all, should include technological solutions and regulatory requirements that contribute to the development of cryptocurrency as one of the types of IT products. In practice, these rules include strict logical methods for developing algorithms for business models of cryptocurrencies and standardized coding languages, on the basis of which the algorithms for these business models are developed. It should be noted that the issues of programming algorithms are not considered as the subject of this paper.

As for "soft" indicators of the competitiveness of cryptocurrencies, we include both psychological and ethical rules for the interaction of participants within the institutional environment, in which, on the one hand, cryptocurrency is created (cryptocurrency developers), and on the other hand, its circulation takes place (cryptocurrency users).

A competitive cryptocurrency should have a new consumer attribute that forms, in contrast to existing cryptocurrencies, its useful effect.

In the first case, approaches to the formation of a team that creates a cryptocurrency are of particular interest. The Agile flexible project management method for developing innovative products [36] and the associated programming methodology Scrum [37] have gained particular popularity. The aim of the Agile method is to use formal and informal relationship between developers' team members to create a competitive IT product in the shortest possible time, by using the Scrum methodology.

Within the framework of the Agile method, the institutional environment of cryptocurrency developers includes the following key elements: selecting participants and reaching an agreement on collaborative activities; agreeing on the team's mission; establishing boundaries of trust between participants; setting goals, objectives, and areas of interest; finding collaboration boundaries; highlighting key success factors and milestones; estimating resource; identifying the required skills for the development process, assessing them and, if necessary, adjusting the team members; review-

ing the results of the teamwork; disbanding the team.

Within the Scrum methodology, cryptocurrency development is implemented in practice by the following main methods:

- the logic and algorithm of the blockchain, establishing conditions of trust and collaboration in the innovative digital economy [38] between developers and users of cryptocurrencies [39, 40];
- the logic and algorithm of the blockchain consensus that solves the problem of the decentralized cryptocurrency turnover by reaching a compromise between transactions;[10]
- the logic and algorithms that form cryptocurrency transactions and protect their turnover, including the generation of cryptocurrency blocks, the formation of the structure of blocks and transactions, etc. [41];
- logic and algorithms of cryptographic protection and storage of cryptocurrency keys [42];
- the logic and algorithms of mining [43] (forging)[11] of cryptocurrencies, etc.

Studies of the market competitiveness of cryptocurrencies have shown that, firstly, the emission of cryptocurrencies is impossible without the processes of mining and forging [44]. Secondly, the logic of consensus algorithms plays a crucial role in transaction performance [45]. In this regard, we will consider this issue in more detail.

ANALYSIS OF THE CONSENSUS ALGORITHM LOGIC IN BLOCKCHAIN

The blockchain consensus algorithm is one of the key mechanisms in cryptocurrency development. Research by Russian patent experts has shown that at present in the international patent landscape, the consensus algorithm is included in almost all of the most cited patents protected in the field of cryptocurrencies. [46]. In general, a consensus is a mechanism for resolving conflicts within a group of participants involved in solving the problem of implementing transactions of a group of participants. A group of participants must side with each other and agree on a solution to the problem of completing the transaction. Blockchain does not implement the principles of distributed consensus, so they are implemented by third-party technologies that are usually used in distributed database systems, etc. The distributed consensus logic in the blockchain differs from the database consensus logic which is network-based. In database consensus, the number of nodes participating in a transaction is always known. In database consensus, blockchain nodes participating in a transaction may be dynamically selected. The behavior of participants in a network that implements distributed consensus is described as the Byzantine Generals Problem.[12] This problem was formulated by Lamport, Shostak, and Pease in 1982 last century [47], and a solution was found in the late 90s. The consensus algorithm includes a set of logical rules in the blockchain of a cryptocurrency, that determine who and under what conditions can confirm transactions, add new blocks, and perform other logical actions [48].

The logic of consensus algorithms ensures the adoption of an automated decision in the cryptosystem by implementing the following basic rules for the interaction of cryptocurrency users:

- agreement: reaching a common agreement of the interacting parties;
- egalitarianism: observance of equality, equal rights to every participant;

[10] Murzin P.E. Basic approaches to developing a consensus protocol in distributed ledgers. URL: https://www.granit-concern.ru/pdf/Murzin_statia_razrabotka_consensa_rr.pdf (accessed on 15.05.2020).

[11] What is forging? URL: https://bulldog.black/2019/04/27/chto-takoe-fordzhing-kriptovaljuty/ (accessed on 15.05.2020).

[12] Byzantine Generals Problem. URL: https://ru.wikipedia.org/wiki/Задача_византийских_генералов (accessed on 15.05.2020).

• cooperation: peers are interested in collaboration;
• inclusion: in the process of reaching agreement, there should be a maximum number of participants.

It should be noted that not only the decision-making process itself is called consensus, but also the decision itself, i.e. the result. Thus, in the blockchain, the consensus algorithm is a set of logically related rules and functions that automatically regulate the operation of the network of cryptocurrency users. Modern blockchain consensus algorithms are based on the logic of algorithms for solving the cryptographic Byzantine Generals Problem. However, the logic of the Byzantine problem was slightly changed and adapted for a P2P network to be used for cryptocurrencies. Considering the logic of this problem with regards to the blockchain, the following main features are distinguished:

Censorship resistance. The blockchain is a decentralized system that does not require a single governing body, hence, no one can prohibit mining to anyone, i.e. ensuring the operation of the network.

Objectivity. The blockchain contains relevant information describing the state of the network. Therefore, blockchain records do not need to be verified by any authoritative sources.

The functions of the blockchain consensus mechanisms are as follows:

The frequency of generating new blocks of records. These algorithms exclude situations each node generates its own block and the block that is added to the blockchain. For example, the Bitcoin network generates blocks every 10 minutes. However, sometimes there are situations when two or more nodes generate a block almost simultaneously, with a second apart. In this case, it leads to a conflict, which is resolved in favor of the node that created the block before everyone else. Transactions of the concurrent block or blocks are listed as invalid transactions and processed in the next block.

Verifying information of the record block. All participants need to confirm that the data in the generated block is correct. The hash transactions of the current and previous blocks are subject to verification, as well as the nonce number.

The amount of reward in the network. The size of the reward depends on the complexity of the network but, oddly enough, is inversely proportional to its complexity.

Preventing double-spending of funds (crypto coins). For example, in Bitcoin, when making a transaction, all funds are sent to the blockchain. After that, the required amount is transferred to the recipient, and the remainder is returned to the sender.

The main feature of the Nakamoto algorithm is that the more network participants, the greater the total computing power of the network, which means that to balance the cost of mined coins in time, it is necessary to increase the complexity of the calculations.

We consider the logic of the main consensus algorithms in the blockchain. ***Proof of Work (PoW)*** *— a proof-of-work algorithm of the network.* The logic of the algorithm determines that dedicated network nodes called “miners” must do the “work” to reach a distributed transaction agreement. The basic condition of the consensus algorithm is that the “work” must be guaranteed to be done. Which dedicated node spends less time on “work”, gets the right to close (commit) the transaction.

The Proof-of-Work concept was coined in 1993 but got its official term only in 1999. The works of Satoshi Nakamoto promoted

a massive application of the described algorithm. The main feature of the Nakamoto algorithm is that the more network participants, the greater the total computing power of the network, which means that to balance the cost of mined coins in time, it is necessary to increase the complexity of the calculations. This approach made it possible to unevenly distribute the number of mined coins over time. The number of mined coins decreases, the value of each mined coin increases.

To earn more crypto coins, miners increase the computing power of the equipment, which leads to a "race" effect. In the first implementation of the Nakamoto algorithm, a personal computer with a single processor was sufficient for mining bitcoins. Now computers need to be combined into farms, computer processors — into a processor pool, or large-capacity mining farms need to be built. Increasing the processing power of mining farms requires large amounts of electricity, which leads to increased global energy consumption due to the rapid obsolescence of computer technology.

Another shortcoming of the PoW algorithm is the low attack resistance of 51% of the involved computing power (computers). It is believed that such attacks are theoretical, however, it is known that for several hours the computing power of a large Russian industrial organization was transferred to the mining of one unpopular crypto coin. The mined coins were transferred to the crypto wallet of one of the organization's employees. Then a huge number of crypto-coins were promptly withdrawn to a crypto-exchange, exchanged for liquid crypto-currencies, sent to another crypto-exchange, and cashed there for fiat money.[13]

Proof of Stake (PoS) *— is an algorithm for proving the share of cryptocurrency ownership in the total cryptocurrency pool.* The PoS consensus algorithm ranks second in popularity due to its use in the implementation of cryptocurrencies. As a concept, the Proof of Stake algorithm was proposed in 2011 during the Bitcointalk forum,[14] and the first implementation of the protocol was introduced by the PeerCoin cryptocurrency[15] in 2012. The algorithm requires network participants — the owners of the cryptocurrency. They unite into groups and delegate their rights to mine coins to one participant, who forms a pool of participants for all their principals. Such a network is called a node.

Another option is also possible when a node is created by one network participant who has a large amount of cryptocurrency in his wallet. Such a participant offers to add other network participants to his node.

Activity management of the community of network participants, as well as the rules for managing consensus, is carried out only by the owners of the nodes, as the rights to this activity are delegated by other members of the network participants.

The node generates blocks in the network. The more coins a node has in a wallet, the more likely it is to generate a new block. Thus, a user who has up to 10% of all cryptocurrencies in a cryptocurrency wallet will be able to generate new blocks of the Blockchain network with an average probability of up to 10%.

In PoS algorithms, the entire amount of coins can be generated, and then these coins may be transferred between network participants. There are many ways to implement the PoS consensus algorithm, which are as follows:

[13] Smirnova E. Caught mining. Mining at work is punished. URL: https://www.forbes.ru/tehnologii/354613-pogoreli-na-kripte-kak-nakazyvayut-za-mayning-na-rabochem-meste (accessed on 15.05.2020).

[14] Cryptocurrencies Without Proof of Work. URL: https://link.springer.com/chapter/10.1007/978–3–662–53357–4_10 (accessed on 15.05.2020).

[15] PeerCoin website. URL: https://peercoin.net (accessed on 15.05.2020).

• Leased Proof of Stake (LPoS) — a leased-proof-of-stake algorithm. This is a pool of network participants with a small number of crypto coins, which they lease to participants with a large number of crypto coins, creating a node. By leasing crypto-coins, the network users get the opportunity to receive their share of the crypto-coins from the mining node, otherwise, the chance to receive a reward is low as the share of the network participant in the general cryptocurrency market is minimum.

• Delegated Proof of Stake (DPoS) — a delegated proof of stake of crypto coins. All network users select nodes to which they delegate the rights to generate new blocks. The selected network participants — node owners — decide on its development, as well as on the configuration of the cryptocurrency network.

PoW was the first algorithm, new algorithms were introduced to overcome its drawbacks. In PoS, cumbersome calculations are not required, which leads to reduced energy consumption and computing power. A 51% attack will also bring the greatest damage to the attacker as the purchase of such a quantity of cryptocurrency will lead to an increase in its value, which will require significant financial costs, therefore, the attack will make the attacker the main victim, because he will become the holder of most of the crypto tokens.

The process of mining cryptocurrency based on PoS consensus is called forging. It consists of setting up a masternode that runs on a dedicated computer, costing $ 70–100. The computer is always connected to the Internet. A crypto wallet with a minimum amount of cryptocurrency constantly runs on a dedicated computer. For example, a DASH node[16] requires 1,000 cryptocurrencies to run; for June 2020 at the exchange rate, this corresponds to $ 775,600. The operation of a masternode can only bring significant profits if transactions are carried out with unpopular cryptocurrencies that are not costly. If their value grows, the owner can increase their number and receive regular rewards on their masternode.

PoS disadvantages are:

• a user has to keep a large amount of coins in his wallet and cannot use them for purchases;

• PoS leads to inequality. The rich get richer, the poor get poorer. For example, a miner who owns 10% of a cryptocurrency receives 10% of all mined coins.

PoW and PoS consensus algorithms are constantly evolving and go in two directions, complicating their logic:

• a combination of algorithms is carried out in various ways. The PoS algorithm is used to generate new blocks, to confirm transactions (or vice versa);

• complication of the logic of the PoS algorithm to eliminate its shortcomings.

Proof of Importance (PoI) — *algorithm for proving the importance of a process*. Logically, the algorithm is similar to the PoS algorithm, but the following criteria are taken into account when generating a block:

• the amount of crypto tokens in the node's crypto wallet;

• network node lifetime;

• the number of successfully completed transactions by the network node.

This algorithm has the following peculiarity: the fewer crypto-coins there are in the node's own crypto wallet, the greater the influence of the number of transactions and the time the node is online on the result of the crypto-currency mining operation.

The logic of this algorithm is introduced, for example, in the NEM[17] cryptosystem, in which each account is assigned with an importance score. As the importance score increases, the account will have a better

[16] DASH website. URL: https://www.dash.org (accessed o 15.05.2020).

[17] NEM website. URL: https://nem.io/ru/ (accessed on 15.05.2020).

chance of receiving a cryptocurrency reward. In order to be eligible for importance calculation, users must hold at least 10,000 NEM crypto coins on the balance. How does the NEM network determine importance scores? If someone owns 10,000 NEM crypto coins or more, then a mathematical recalculation of transactions occurs. The increase in transactions on the network associated with this account will lead to an increase in the importance score. There is an opinion this threshold will be changed in the future. This method also ensures that users, NEM holders, will continue to save their funds. This method may be considered as the logic of creating a masternode. The project also provides visitors the ability to rank the importance of individual accounts on the network, which is a good way to keep the decentralized network going. The collection of rewards on the NEM blockchain is almost the same as in traditional mining. Its purpose is to add transactions to the blockchain in exchange for financial rewards.

Proof of Authority (PoA) *— a proof of authority algorithm*. Network participants give the right to create new blocks to the selected nodes. PoA can be applied to regulated and corporate cryptosystems. The PoA algorithm is not decentralized, all blocks are under the control of the developer. Therefore, it can be expected that it is the PoA algorithm that may be implemented in state cryptosystems.

Proof of Capacity (PoC) u Proof of Storage *— are algorithms for confirming the capacity of a computer's working memory*. This algorithm implies monetization of the allocated memory on the hard disk of the computer of a network participant. There are options to implement these algorithms to isolate the computing (processing) power of the computers of the network participants, which is also monetized.

Proof of Stake Time (PoST) *— a proof-of-stake algorithm is based on the age of the cryptocurrency*. In this case, instead of considering the number of cryptocurrencies, the period of time during which the cryptocurrencies were stored at a specific address is used to calculate their age. The algorithm is implemented in the VeriCoin cryptocurrency.[18]

Delegated Proof Of Stake (DPOS) *— an algorithm for delegating proof of ownership of a cryptocurrency*. DPOS uses EOS[19] and BitShares,[20] cryptocurrencies, while EOS uses consensus logic to scale the process to millions of transactions per second.

DPoS is different from Po S. In DPoS, stakeholders do not vote on the validity of the blocks but vote to elect delegates to do the validation on their behalf. There are between 21–100 elected delegates and they are shuffled periodically. The system is efficient. If the elected nodes continually miss their blocks or publish invalid transactions, stakeholders vote them out and replace them with a better delegate.

In DPoS, miners collaborate to make blocks which does not happen in PoW and Po S. Due to partial centralization in block creation, DPoS algorithm can work orders of magnitude faster than most other consensus algorithms.

TAPOS *— an algorithm in which a transaction is a proof of stake*. The algorithm is implemented in the software of the EOS crypto system. In this system, each transaction must contain a hash (reference) to the previous transaction. This ensures the following:

- preventing transaction reversal;
- generating a network signal indicating that the user and his share are in a certain fork;
- shaping a network signal that prevents validators from acting maliciously for purposes unforeseen by the logic of the process.

[18] VeriCoin website. URL: https://vericoin.info (accessed on 15.05.2020).
[19] EOS website. URL: https://eos.io (accessed on 15.05.2020).
[20] BitShares website. URL: https://bitshares.org (accessed on 15.05.2020).

BFT *— Byzantine Fault Tolerance (also Byzantine Generals Problem) algorithm*. It is implemented in Hyperledger,[21] Stellar,[22] Ripple[23] and other cryptocurrencies. The Federated Byzantine Agreement (FBA) is used with Stellar and Ripple cryptocurrencies. The idea is that each byzantine general, responsible for his own blockchain, sorts all messages in order to validate the truth. In Ripple, validator generals are pre-elected by the founders of Ripple. In Stellar, anyone can be a validator, therefore the user chooses which validators to trust. It is used for its high throughput, low transaction costs, and scalability. Currently, this algorithm is also actively used in Hyperledger Fabric. This provides high transaction throughput while fully centralizing the entire process.

dBFT *— a Delegated Byzantine Fault Tolerance* implemented in NEO.[24] The NEO creators have chosen this algorithm to provide better scalability and higher process performance. To explain the logic behind dBFT, we use the following simplified analogy. There is a country called NEO. Every citizen of a country has the right to vote when electing a leader, called a delegate. All the delegates form the laws of the country. If citizens disagree with how a delegate voted on the law, they can vote for another delegate. Then the citizens tell their elected ones what they want from them. Each delegate must keep track of the demands of all citizens and write them down in the book. These demands will be taken into account when passing laws aimed at ensuring that citizens are happy. When the time comes to pass a law, a speaker is randomly assigned from a group of delegates. He proposes a law based on the demands of citizens. In the proposed law, he explains how the law will affect a country's happiness number. The speaker will then personally present the proposed law to the delegates. Delegates decide whether the speaker's happiness level calculation matches their own. If 66% of delegates agree that the calculated number of happiness is correct, the law passes. If less than 66% of the delegates agree, a new speaker is selected randomly and the election process is repeated again. Thus, this algorithm is designed to protect citizens from traitors and leaders.

To ensure their competitiveness, cryptocurrency developers are advised to responsibly choose the consensus algorithm that forms rules aimed at solving the Byzantine Generals Problem of the cryptocurrency blockchain.

Applying this analogy to the NEO blockchain, anyone owning NEO is a citizen. The majority of NEO holders are Ordinary Nodes that can only transfer or exchange assets. Like citizens in the country of NEO, they do not participate in block validation. Delegates represent Bookkeeping Nodes in the NEO Economy. Bookkeeping Nodes verify each block written to the blockchain. To become a Bookkeeping Node certain requirements must be met, such as special equipment, dedicated internet connections, and a certain of amount of GAS[25] (1,000 at the time of writing). Then, the following logic is used: The law represents the current block in the blockchain and the Happiness Number is the hash of the current block.

The aBFT consensus algorithm is used in the Hashgraph cryptocurrency, in which nodes distribute their transactions random-

[21] Hyperledger website. URL: https://www.hyperledger.org/projects/fabric (accessed on 15.05.2020).

[22] Stellar website. URL: https://www.stellar.org (accessed on 15.05.2020).

[23] Ripple website. URL: https://ripple.com/xrp/ (accessed on 15.05.2020).

[24] NEO website. URL: https://neo.org (accessed on 15.05.2020).

[25] NEO website. URL: https://neo.org (accessed on 15.05.2020).

ly to other nodes. Therefore, transactions may "intertwine" around nodes. Hashgraph processes up to 250,000 transactions per second but it is not resistant to attacks like Sybil,[26] so it is only suitable for small private networks.

Proof Of Activity (PoA) — *a proof-of-activity algorithm* implemented in the Ethereum Kovan testnet.[27] This is a consensus algorithm, in which transactions are checked by dedicated "accountants", whose functions are similar to those of the system "admins". Other nodes learn about the state of the process from the "accountants". PoA has high bandwidth and is optimized for private networks. Obviously, due to the centralization of the process, PoA will not be able to function effectively in public networks.

Proof Of Burn — *coins burning algorithm* is implemented in Slimcoin.[28] The logic of the algorithm is that the miner has difficulties mining crypto-coins without attracting real resources, as in PoW algorithm with its power consumption costs and equipment. It also differs from PoS, in which it is necessary to accumulate cryptocurrencies.

By "burning" is meant the process of sending cryptocurrencies to an unspendable address (the details vary from cryptocurrency to cryptocurrency). Thus, the process script implies "deliberately silly" logic. But whoever donates crypto coins (similar to investing in mining) gets the right to charge a transaction fee. At the stage of earning a cryptocurrency, this is very useful for its market price.

Proof of Weight — *a proof-of-weight algorithm* is used in crypto systems Algorand,[29] Filecoin,[30] etc. This is a whole group of consensus algorithms. The general idea is that if in PoS, your percentage of tokens owned by the network gives you the likelihood of "finding" the next block, then PoWeight uses a different weighted value. Example: in the Filecoin Proof of Spacetime system, weighted by the number of IPFS cryptocurrencies in storage. Other systems may include conditions such as "proof of reputation".

Proof of Checkpoint — *an algorithm for checking matching blocks*. It is a hybrid algorithm that may use any PoS cryptocurrency system with a PoW algorithm. Each block used in one algorithm must find a similar block in another algorithm. The rhythm of the algorithm mitigates Proof of Stake attacks. However, hosts that are offline for an extended period of time are still vulnerable to these attacks. Disabled nodes when enabled can be used to provide false information about the blockchain.

Directed Acyclic Graphs (DAG) — *a directed acyclic graph algorithm*. DAG logic algorithms use Iota,[31] Hashgraph,[32] Raiblocks/Nano.[33] The DAG algorithm logic does not analyze the entire structure of the blockchain but processes its transactions asynchronously.[34] This makes it possible to process a significant number of transactions per second.

A specific example of a DAG-type consensus algorithm is Tangle,[35] used by Iota. In order to send a transaction, a user need to confirm two previously received transactions. Consensus logic, implemented on a two-for-one basis, enhances the validity

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of transactions. Since the consensus is established by the transactions, in theory, if someone can generate one third of all the transactions, they can take over the entire network. Therefore, Iota is "double-checking" of all network's transactions on a centralized "coordinator" node, which first functions to keep the system running, and then, when the number of processed nodes becomes very large, is removed.

CONCLUSIONS

The research results showed that the institutional features of the development of a competitive cryptocurrency were influenced not only by the development of information technologies, but also by the development of philosophy, mathematics, economics and finance. Analysis of "soft" and "hard" competition rules, institutional environment and methods that ensure the development of cryptocurrency shows that thanks to the efforts of many scientists and practicing programmers from around the world, cryptocurrency has become a new competitive asset (IT product) of modern finance.

The paper discusses in detail one of the "hard" rules of competition — the logic of blockchain consensus algorithms, which makes one of the main contributions to ensuring the competitiveness of cryptocurrencies. The analysis of the consensus logic is carried out for a limited number of algorithms that exist or are being tested. It has been shown that historically the first consensus algorithm was PoW, which is implemented in many cryptocurrencies of the Top 10 cryptocurrency list. Thus, in practice, this particular algorithm is the most common among cryptocurrency developers. However, its competitor (PoS algorithm) is already gaining its share of the cryptocurrency market, therefore, for example, Ethereum is switching to this algorithm. Research has revealed that the most promising are hybrid algorithms. They either combine the logic of PoS and PoW algorithms or are the results of the development and refinement of one of them (most often PoS logic).

Based on the results of the study, the following conclusions can be drawn.

Firstly, all consensus algorithms implement certain logical dependencies, and they have both strengths and weaknesses, so you need to be a professional mathematician to analyze this logic in detail. Most often, the differences in the names of the blockchain consensus algorithms emphasize the specifics of the logic: Work, Stake, Authority, Storage, etc.

Secondly, the logics of the development of blockchain consensus algorithms presented in the study are applicable to almost all cryptocurrencies, therefore, they are defined as the main ones:

- agreement;
- egalitarianism (business model of a specific cryptocurrency or cryptosystem determine the specifics of its implementation);
- cooperation;
- inclusion (it determines the algorithm "hacking" resistance, which may change under different conditions, therefore, only applied mathematicians can find inclusion specifics);
- censorship resistance;
- objectivity;
- frequency of generating new blocks of records (depends on the implementation technology of consensus algorithms, which have no such limits, as a rule);
- verification of information in the block of records (depends on the implementation technology of consensus algorithms, however, many methods of the verification may be implemented for the same algorithm);
- reward amount in the network (determined by the developer's view on its amount when implementing a specific consensus algorithm for a specific cryptocurrency);
- preventing double-spending of cryptocurrency (the procedure is mandatory for

the implementation of business models for all types of cryptocurrencies — the logic of the procedure provides a transaction that functions in parallel with the implementation of the main algorithm).

Thirdly, each cryptocurrency has unique characteristics, the analysis of which makes it possible to compare the effectiveness of the implementation of their business models to assess competitiveness. The practice has shown that the same business model can be implemented in several ways and based on different consensus algorithms. Therefore, it is possible to compare the competitiveness of the logic of consensus algorithms only after they are applied in the business models of specific cryptocurrencies, which will reveal their competitiveness in the crypto markets.

Thus, to ensure their competitiveness, cryptocurrency developers are advised to responsibly choose the consensus algorithm that forms rules aimed at solving the Byzantine Generals Problem of the cryptocurrency blockchain. These rules provide transactions with the information they use to reach consensus, keeping the network secure, and eliminating connection hang-ups. However, it should be emphasized that the conclusion about the competitiveness of a particular cryptocurrency can only be ensured by practicing in the crypto market

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Impact of the Behavioral Cycle on Cash Flow Formation

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ABSTRACT

This study highlights the mechanisms of the behavioral cycle impact on the cash flows generation. The need to develop original approaches to the analysis of the behavioral cycle associated with the dominant behaviors change demonstrates the **relevance** of the research. The **aim** of the study is to determine the mechanism of the behavioral cycle impact on the actions of economic entities. The authors use the method of statistical analysis of the Rosstat data from 1998 to 2018 to test two hypotheses: 1. The behavioral cycle impacts the distribution of household income between consumption, savings, and investment; 2. The actions of economic entities with active behaviors do not always lead to further actions of economic entities with an adaptive and reactive type of behavior. The study examines the structure of the household income use and the dynamics of the index of expected changes in the economic situation in Russia in a year. The behavioral cycle has been shown to have a direct impact on consumption and investments. The economic actions of the entities are influenced by the formed dominant behaviors, as well as the macroeconomic conditions. The authors **concluded** that the behavioral cycle is not able to change the structural imbalances in the economy, however, it can increase their potential impact, since it facilitates the adoption of certain economic decisions by economic entities and largely determines the dynamics and direction of cash flows in financial markets. The behavioral cycle reflects the moods and expectations of economic entities. The behavioral cycle change occurs due to the significant actions performed by economic entities with active behaviors aimed at changing the external environment. The **results** of the study demonstrate the feasibility of developing countercyclical mechanisms for smoothing out socially unfavorable outcomes of the activities of economic entities at various phases of the behavioral cycle. The authors propose to monitor the phases of the behavioral cycle based on the analysis of the cash flow generation.

Keywords: behavioral cycle; cash flows; uncertainty; types of behavior; economic growth; Bank of Russia; monetary policy

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INTRODUCTION

The study examines the influence of the behavioral cycle on the cash flow generation. The generation of cash flow depends not only on the actual amount of funds available to an economic entity but also on the volume of transactions performed by the entity, with the amount of funds available to it.[1] The behavioral cycle reflects the dynamics of changes in the expectations and sentiments of economic agents regarding the future.[2] Subjects form expectations by analyzing incoming information. Expectations about the future lead to the formation of a dominant type of behavior that determines the further actions of economic agents.[3] Economic agents make decisions considering the current information background, their own assessments of the state of the economy, as well as the actions of other agents. For example, an employee evaluates the stability of their employment and then decides how to distribute their income between consumption and savings. The employee also needs to consider the likelihood of his dismissal, even if there is a stable employer. Thus, the employee is constantly faced with the problem of uncertainty, which affects the model of his behavior. Decision making by economic entities is significantly influenced by the educational and professional profile of the economic agent [1].

Previous experience of economic crises and significant changes in the external environment plays an important role, such as, the COVID-19 pandemic, for example. These factors determine the formation of the dominant type of behavior of economic agents, which affect their actions. Expectations that determine the formation of a certain type of behavior tend to accumulate, which allows us to talk about the existence of periodic fluctuations in the dominant behavior of economic entities, formalized through a behavioral cycle. Stages of the behavioral cycle affects the generation of cash flows in the economy by changing the factors that determine the decisions of economic agents. By analyzing the existing stages of the behavioral cycle, it is possible to predict changes of the cash flow generation.

Soviet economists considered the issues of economic development to a greater extent from the position of changing the structure of the economy, the distribution of economic resources [2]. The choice of directions for the cash flows geberation was carried out according to the set strategic goals. This approach makes it possible to consider long-term deep economic trends that form the general direction of the country's economic development. It is the structure of the economy and its imbalances that determine the emergence of economic cycles that may significantly change the overall dynamics of the country's development. However, this approach practically does not take into account the distorting effects associated with changes in the dynamics of the behavior of economic entities. Cyclical behavior changes may have an impact on economic development, however, the impact will be much lower compared to economic cycles. At the same time, the imposition of the behavioral cycle on the economic cycle may lead to significant crisis phenomena. The behavioral cycle will enhance all negative structural impacts of the economy. It should be noted that the behavioral cycle may also positively influence the dynamics of economic development.

Each economic agent demonstrates a type of behavior that determines his actions. The characteristics of the subject's actions, considering his type of behavior, represents a micro level analysis of the situation. In turn, the overall analysis of the characteristics of the individual behavior of the entire set of economic entities leads to understanding the dominant type of behavior at the macro lev-

[1] For example, a business entity may have 100 rubles and with its help make transactions for 1000 rubles.

[2] By economic entities are meant both individuals and legal entities. Legal entities are run by people and therefore they also have certain behaviors.

[3] The dominant type of behavior is understood as behavior (active, adaptive or reactive), which stimulates the emergence of actions (or their absence) that have the greatest impact on the dynamics of economic development at the moment.

el. The analysis of the actions of subjects at the macro level, influenced by the dominant type of behavior, determines the impact of the stages of the behavioral cycle on economic development.

The behavioral cycle fluctuations lead, first of all, to the transformation of cash flows distribution. A change in the dominant type of behavior changes the actions of an economic entity, which is expressed in a change in the share of consumption expenditures, savings, and investment. The analysis of cash flows allows us to retrospectively assess the relationship between the dominant type of behavior of economic agents and the generation of cash flows. The change in the distribution of cash flows is a key factor confirming the impact of the behavioral cycle on the macroeconomic state of the economy. In this study, consumption, savings, and investment indicators will be taken into account, when analyzing the impact of the behavioral cycle on the distribution of cash flows.

This article is divided into several sections. The first section includes a literature review, revealing the practices and the mechanism of the formation of the behavioral cycle. The key emphasis is on studying the mechanism of the impact of the behavioral cycle on macroeconomic indicators.

The second section describes the statistical indicators and the main hypotheses of the study.

The formulated hypotheses are tested using statistical analysis in the third section. Based on the results, practical recommendations for assessing the impact of the behavioral cycle on the formation of cash flows are revealed.

LITERATURE REVIEW

The study of the behavioral cycle includes the analysis of the mechanism of its occurrence and the change in the stages of the behavioral cycle, the assessment of the degree of its influence on macroeconomic indicators, the establishment of the frequency of stages [3]. The behavioral cycle is the result of the formed dominant types of behavior of subjects, which are based on human psychology. Due to its peculiarities, errors occur related to the individual motives of people and the logic behind decisions. The economic decisions of the subjects are significantly influenced by education, professional activity, and previous life experience [4]. Insufficient consideration of the human factor leads to inaccurate interpretation of economic phenomena [5]. In this regard, it is necessary to develop new approaches to increasing the degree and quality of taking into account the behavioral motives of the subjects.

People's expectations determine the mechanism of an individual choice of the subject [6]. However, it is necessary to understand that people's expectations tend to accumulate. If there is an improvement in the economic situation, then a person will also expect its improvement in the future. As a result, positive expectations about the future will accumulate, forming a dominant type of behavior. An economic agent forms certain expectations concerning any situation, and the type of behavior determines his predisposition to carry out a certain set of actions, considering the formed expectations. In turn, the formation of dominant types of behavior in a set of subjects creates conditions for the emergence of a behavioral cycle. The dominant type of behavior involves the implementation of actions that have the greatest impact on economic development.

The formation of a behavioral cycle occurs due to a change in the dominant types of behavior. Economic subjects in their activities demonstrate three main types of behavior: active, adaptive, and reactive [7]. In society, "rising" and "falling" phases of alertness appear. The change in the stages of the behavioral cycle occurs due to the actions of subjects with an active type of behavior, which identify problems and possible prospects for themselves in the structure of the economy. Subjects with an active type of behavior take preventive actions aimed at maximizing their gain. As a result, there is a change in the mar-

ket, leading to a change in the achieved balance. Observing the changes, subjects with an adaptive type of behavior take actions to preserve their accumulations. They are trying to adjust to the new economic reality. The actions of subjects with an adaptive type of behavior lead to an increase in the emerging trends in the economy. Subsequently, subjects with a reactive type of behavior perform belated actions (or do not), trying to preserve their accumulations. However, they only lose their money: subjects with a reactive type of behavior, belatedly striving to join a group of subjects with an adaptive type of behavior, lose more than other subjects. These processes accompany the economic cycle. As a result, in order to regulate economic processes, it is necessary to monitor not only the economic but also the behavioral cycle, which characterizes the behavioral predisposition of economic entities to negative or positive economic phenomena.

Due to the fact that the behavioral cycle reflects the perception of the subjects of the political and economic environment, the problem of identifying and measuring the behavioral cycle arises. One of the possible solutions is to track the main actions taken by the subject when the economic situation changes. First of all, a change in the expectations of an economic entity affects the distribution of generated cash flows. Taking into account the rate of dynamics of changes in the main financial indicators is an important source of information about the state of an economic entity [8].

When economic agents change the stage of the behavioral cycle, they change the established approaches to the formation of cash flows. In particular, economic theory assumes that a consumer disproportionately distributes his income between consumption and savings [9]. An increase in income will lead to an increase in savings but if a person foresees a worsening economic situation in the future, he will strive to save his funds by buying expensive assets. As a result of the actions of subjects with an active type of behavior, a change in the stage of the behavioral cycle may occur. An indicator of a change in the phase of the behavioral cycle is the transformation of the structure of the generation of cash flows. The change in the state of the cash flow is the result of the influence of changes in the dominant sentiments of economic agents. In this regard, the Bank of Russia should monitor their formation in order to predict further trends associated with the dynamics of the behavioral cycle. In addition to the Bank of Russia, other government agencies should also monitor the phases of the behavioral cycle. To apply this approach, it is necessary to confirm there is a connection between the behavioral cycle and the structure of using the income of economic entities.

USED DATA AND RESEARCH METHODS

The change in the phase of the behavioral cycle affects the change in the dynamics of the distribution of cash flows. This study examines the effect of the behavioral cycle on the distribution of cash flows between consumption, saving, and investment. The behavioral cycle influences the economic decisions of households to a greater extent, as they are less subject to contractual obligations and cost planning than other economic agents. Based on the formed expectations, households can quickly change the structure of their income distribution between these three categories. As a result, the following hypothesis may be generated:

Hypothesis 1. The behavioral cycle leads to a change in the distribution of household income between consumption, savings, and investment

Insufficient available data create certain challenges when testing this hypothesis. The Rosstat data on the structure of the use of income of the population (*Table 1*) will be used to test this hypothesis. Data are taken for the period from 1998 to 2018.

The indicator reflecting the volume of investment is represented by the indicator “Purchase of foreign currency”. The assumption

Table 1

Description of indicators used to confirm hypothesis 1

Indicator	Characteristic
Consumption	Consumption includes two indicators: "Purchase of goods and payment for services" and "Mandatory payments and various contributions", %
Savings	Savings includes the indicator "Saving", as well as "Increase (decrease) of currency in hands", %
Investment	Investment is represented by the indicator "Purchase of foreign currency", %
Index of expected economic changes in Russia in a year	Average values of the indicator were calculated annually, %

Source: compiled by the authors, based on the Rosstat data.

made by the authors about the possibility of using the indicator "Purchase of foreign currency" as an indicator of the volume of investments is due to the fact that when performing foreign exchange transactions, households face risks. In some cases, households may receive additional income, while in others, they may lose their savings (for example, if the dynamics of the exchange rate is unfavorable). In this regard, the direction of funds for the purchase of foreign currency may be considered as the most accessible form of investment for households.

As an indicator reflecting the dynamics of the behavioral cycle, the average values of the "Index of expected economic changes in Russia in the year" will be used. The calculation of average values is necessary to correlate the phase of the behavioral cycle with indicators of the structure of household expenditures. Verification of the hypothesis will mean the possibility of using the data on the distribution of cash flows to assess the dynamics of the behavioral cycle.

The process of changing the phases of the behavioral cycle begins with the actions of economic entities with an active type of behavior, differing in the strength of their impact on the market. In fact, there is a certain threshold level, exceeding which would mean the emergence of long-term consequences of fluctuations in the behavior cycle for economic development. An insufficient level of influence of entities with an active type of behavior will lead to fluctuations in the short term, which is expressed in the emergence of volatility in the market. As a result, the following hypothesis can be put forward:

Hypothesis 2. The actions of subjects with an active type of behavior do not always lead to subsequent actions of subjects with an adaptive and reactive type of behavior.

Subjects with an active type of behavior will tend to change the parameters of the external environment but their actions will not always be supported by subjects with an adaptive and reactive type of behavior. As a result, a change in the stage of the behavioral cycle may not occur. Thus, subjects with an active type of behavior, expecting and at the same time contributing to a change in the stage of the behavioral cycle, will take actions aimed at increasing their income, thereby influencing a change in the structure of cash flows. However, the influence may be insufficient for the change in the dominant type of behavior. This hypothesis will be tested by considering the impact of bankruptcy reports on banks' financial situation.

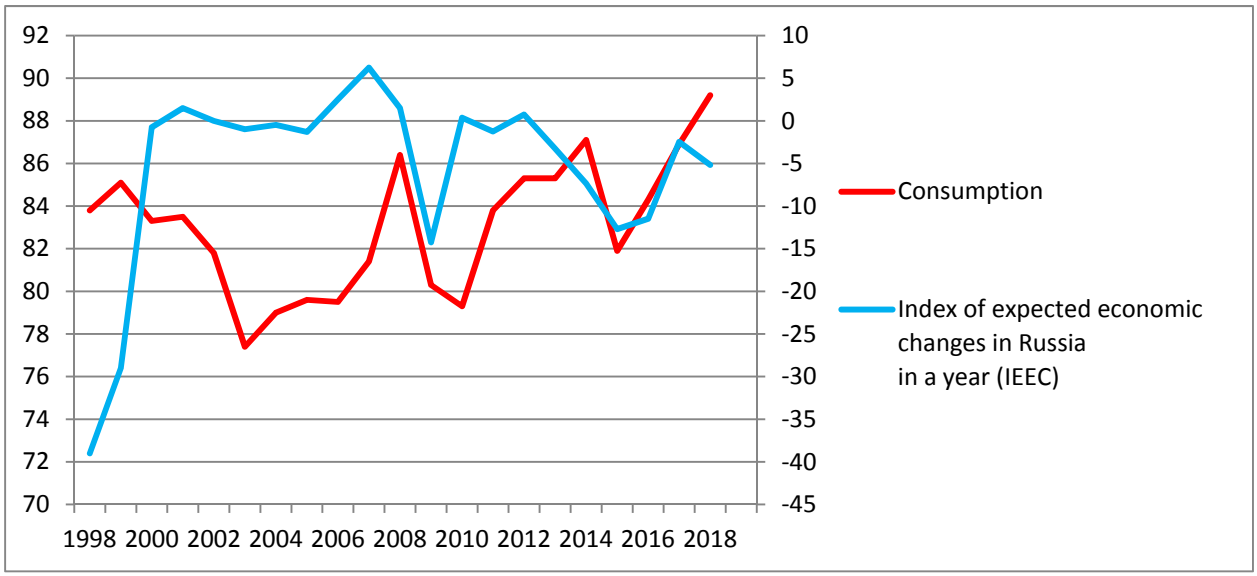

Fig. 1. **The share of consumption in the structure of the household income use, as well as the values of the index of expected changes in the economic situation in Russia in a year**

Source: compiled by the authors, based on the Rosstat data.

EMPERICAL RESULTS OF THE STUDY

To test the first hypothesis that the behavioral cycle leads to a change in the distribution of household expenditures between consumption, saving and investment, it is necessary to analyze the structure of the use of household income, as well as the dynamics of the index of expected economic changes in Russia in a year (*Fig. 1*).[4]

The data show that positive or negative dynamics of expectations is accompanied by an increase or decrease in the share of consumption. This was noticeable even before the start of the global financial crisis in 2008. The economic entities were aware of the high probability of a crisis, due to which they began to adapt their consumption in advance. Thus, the existence of a relationship between the distribution of household income for consumption and expectations about the future is confirmed. At the same time, up to 2006, there was an inverse relationship between consumption and expectations, which is probably associated with an increase in real incomes of the population, which made it possible to increase spending on savings and investments. Moreover, the national currency was strengthening, which was considered as a constraining factor for the growth of consumer prices. After 2008, there was a change in the model of consumer behavior, which may be related to the awareness of the possibility of a crisis in the economy. As a result, people preferred spending their income on consumption rather than using it for savings and investment.

It is quite an interesting fact that the share of consumption increased after 2014, which may be associated with a drop in real incomes of the population. A drop in real income may occur due to the COVID-19 pandemic. According to experts, a drop in real incomes in the first 2 quarters of 2020 could reach 18%.[5] The population strives to maintain the usual standard of living, and therefore, the share of consumption in expenditures will continue to grow. It should be noted that the potential to replace other uses of cash income is lim-

[4] The behavioral cycle in this paper is assessed using the dynamics of the index of expected economic changes in Russia in a year. It is important to understand that there are differences between expectations and behavior. Expectations lead to the formation of the type of behavior of the subject. The development of an approach to consider the dynamics of the behavioral cycle should be the subject of a separate research.

[5] URL: https://www.rbc.ru/economics/03/06/2020/5ed6803f9a79471039f22c17 (accessed on 07.09.2020).

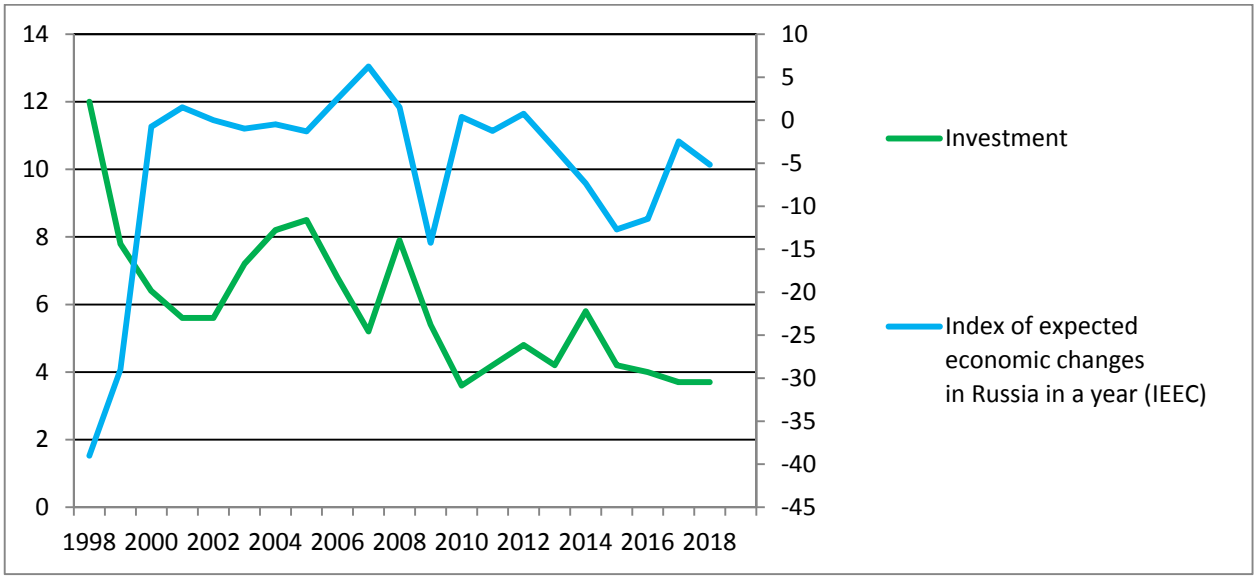

Fig. 2. **The share of investments in the structure of the household income use, as well as the values of the index of expected changes in the economic situation in Russia in a year**

Source: compiled by the authors, based on the Rosstat data.

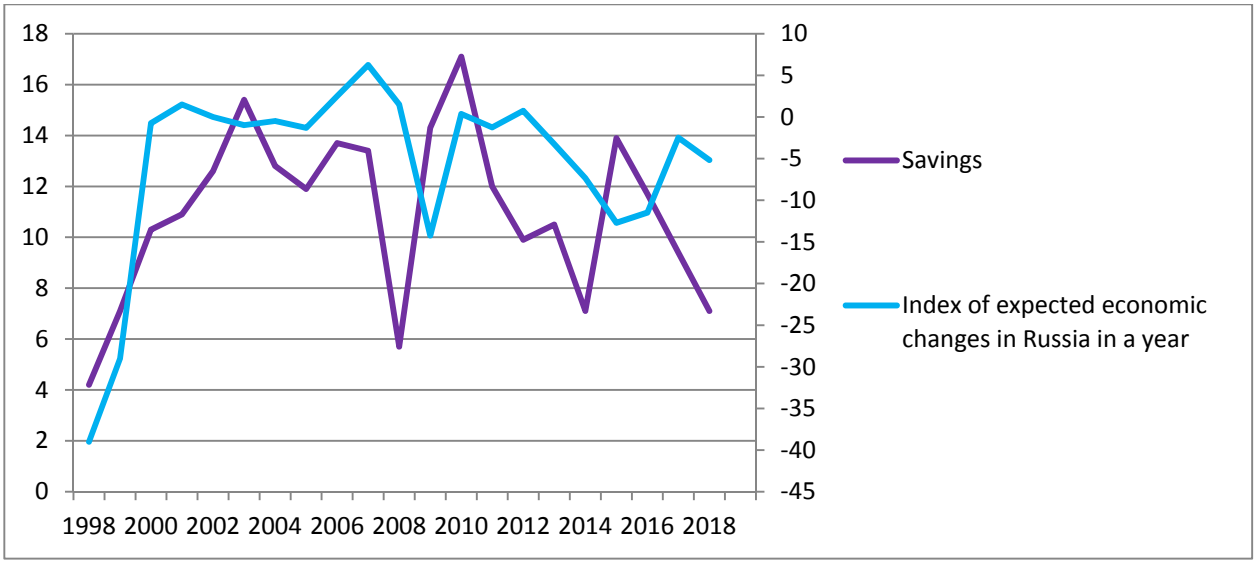

Fig. 3. **The share of savings in the structure of the household income use, as well as the values of the index of expected changes in the economic situation in Russia in a year**

Source: compiled by the authors, based on the Rosstat data.

ited. The share of consumption, according to Rosstat, in 2018 amounted to 89.2%, of which 77% accounted for the purchase of goods and payment for services, and 12.2% — for the payment of mandatory payments and various contributions.

If we look at the dynamics of investments, it is obvious that when expectations deteriorate, the volume of household investment increases, and when expectations improve, investment decreases (*Fig. 2*). The latter is probably due to the fact that investments in this study are represented by the indicator "Purchase of foreign currency" (buying foreign currency is indeed the most accessible form of investment for ordinary Russian households). Changes in the behavior model of households in relation to investments did not take place

after 2014 either. The latter may be related to the accumulated experience of default of 1998, the global financial crisis of 2008. Investment in foreign currency are considered by households as the most profitable and affordable.

If we look at the share of savings in the structure of the use of funds by households, we can also see a certain dependence (*Fig. 3*). Moreover, the change in the share of savings occurs earlier than the change in expectations. Thus, it can be assumed that households form their estimates for the future based on the analysis of information on the share of income used for savings. Reducing the ability of households to direct income to savings leads to a change in their expectations about the future and as a result of the dominant type of behavior.

Obviously, a change in the expectations of economic entities leads to the formation of a dominant type of behavior that determines the actions of households in the distribution of income between consumption, saving, and investment. The behavioral cycle has a direct impact on consumption and investment rates. Thus, the hypothesis about the impact of the behavioral cycle on the distribution of household income between saving, consumption, and investment is confirmed.

The scale of the impact of subjects with an active type of behavior on the economic situation depends on the existing stage of the behavioral cycle, as well as on the real macroeconomic conditions. In this case, the accumulation of the previous experience of the crisis occurs. An example of such a situation is several information attacks on the banking sector by sending SMS messages about the imminent bankruptcy of a bank, as well as by posting this information on the Internet (*Table 2*). Initially, such messages lead to spontaneous actions of depositors seeking to withdraw funds. However, the refutation of information in most cases helps to avoid spontaneous reactions from subjects with adaptive and reactive behavior. The latter, among other things, is due to the fact that the information provided was not confirmed by the economic state of the bank, which is why some subjects with an adaptive and reactive type of behavior decided not to take spontaneous actions but to wait for an official statement from the bank.[6]

If the subjects form expectations that are not met, then the next time a similar economic situation arises, a change in the dominant type of behavior may not occur. In the future, having received information about the bankruptcy of the bank, depositors will additionally check the information and not take early actions to withdraw cash.

The heterogeneity in the actions of subjects with different types of behavior can be demonstrated by analyzing the dynamics of exchange trade indicators and the dollar exchange rate for "tomorrow" settlements, taken into account for the period from May 27, 2014 to November 30, 2016. (*Fig. 4*). It is obvious that with the growth of the dollar exchange rate, the turnover of the US dollar also increased. At the same time, the turnover peak (October 30, 2014) was reached before reaching the maximum value of the dollar exchange rate in 2014. This is probably due to the fact that the turnover growth was caused by the actions of subjects with an active type of behavior, "shaking up" the market but not finding support at the moment from subjects with an adaptive type of behavior.

With the next peak increase in the dollar exchange rate in 2015, the turnover peak coincided with the maximum value of the US dollar rate paired with the Russian ruble, which may be due to the fact that, in addition to subjects with an active type of behavior, some subjects with an adaptive type of behavior started to carry out transactions. At the same time, the turnover volume did not reach the peak values of 2014, which is probably because the increase in turnover was not supported by all subjects with an adaptive type of behavior, as well as partially by subjects with a reactive type of behavior. In 2016, the dollar was grow-

[6] All listed banks continue their activities at the present time.

Table 2

Examples of inaccurate bank bankruptcy messages

Name of the bank	Case description	Source
Guyana Bank for Trade & Industry	In 2009, a message appeared on the Internet that the bank had asked for emergency financial assistance from the government. It resulted in a panic among the depositors, which was stopped when the information was officially refuted	URL: https://www.securitylab.ru/news/369254.php
"Vozrozhdenie Bank" (PAO)	In 2013, there was a false report about the bankruptcy of Vozrozhdenie Bank. As a result, the depositors withdrew some of the funds. The bank secured sufficient cash in ATMs to demonstrate its solvency	URL: https://www.kommersant.ru/doc/2324712
AKB "Almazergienbank" AO	In 2014, there was information about the bankruptcy of the bank, which was refuted by the official statement letter on the Internet	URL: https://albank.ru/ru/news/?ELEMENT_ID=487
PAO "AK BARS" BANK	In 2017, information appeared about the revocation of the bank's license. This information was later refuted	URL: https://kazan.aif.ru/money/banks/ak_bars_bank_oproverg_informaciyu_ob_otzyve_licenzii

Source: compiled by the authors.

ing and significantly increasing its turnover again. In this case, it can be concluded that the actions of subjects with an active type of behavior were also supported by subjects with an adaptive and reactive type of behavior. However, this situation was not observed in all cases of changes in the US dollar exchange rate over the period under review.

Thus, the hypothesis is confirmed that the actions of subjects with an active type of behavior do not always lead to significant actions on the part of subjects with an adaptive and reactive type of behavior. In the case of reports on bank bankruptcies, bank employees published refuting counterinformation and conducted an active information policy, which made it possible to maintain the required amount of funds in bank accounts. For currency turnover, subjects with adaptive and reactive types of behavior took time to gain experience and develop their own tactics for responding to the Russian ruble exchange rate drop.

At the same time, it should be noted that a change in the dominant type of behavior, not supported by the real economic situation, may lead to significant losses for economic entities. The key indicator reflecting the change in the sentiments of economic entities is the change in the mechanism for generating cash flow. The Bank of Russia, as a mega-regulator, can monitor the current stage of the behavioral cycle to predict possible actions of economic entities. To this end, the Bank of Russia can use all available information on the cash flow generation in the national payment system, including the payment system of the Bank of Russia.[7] Particu-

[7] It should be noted that the Bank of Russia started publishing data on the state of cash flows within the Bank of Russia payment system in 2020. This analysis should be extended to all cash flows through the national payment system.

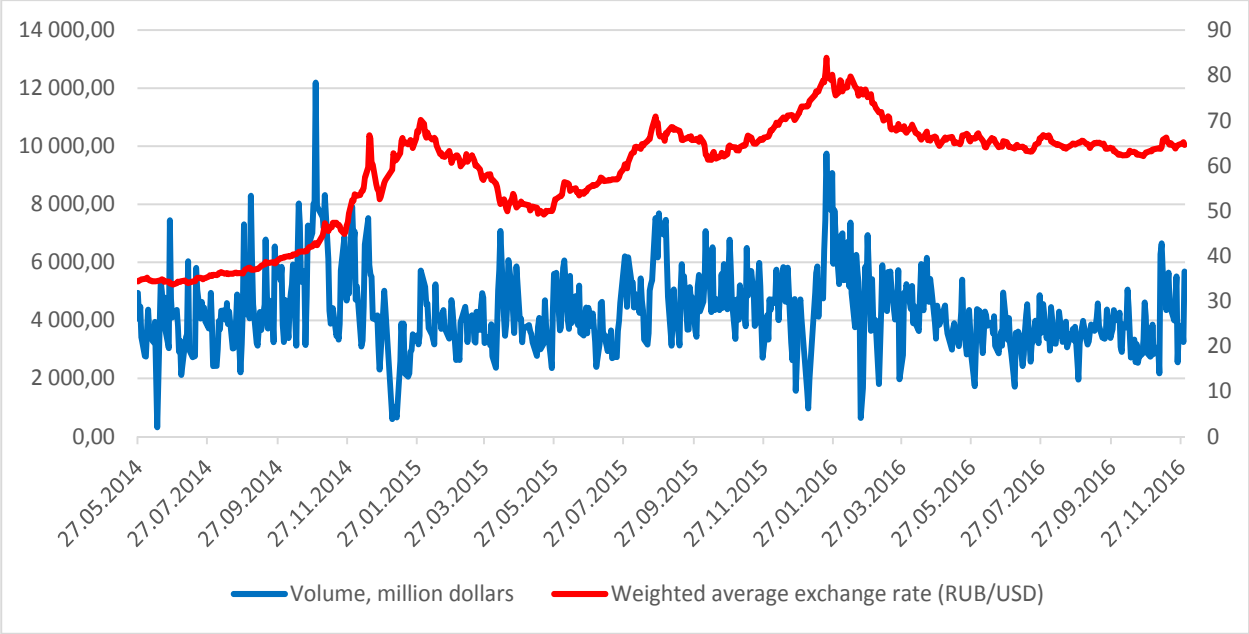

Fig. 4. **Dynamics of US dollar exchange rates and indicators of exchange trading for "tomorrow" settlements**

Source: compiled by the authors, based on the Bank of Russia data.

lar attention should be paid to indicators of cash turnover within the payment system, as well as assessing the degree of interdependence of cash flows [10].

To reduce the possible negative impact of fluctuations in the stages of the behavioral cycle, it seems appropriate to develop mechanisms to prevent spontaneous withdrawal of funds from financial institutions. For example, the latter is especially important when receiving false information about the possible bankruptcy of a commercial bank. Advances in digital technology have shortened the time between getting information and taking an action. As a result of receiving inaccurate information about the bankruptcy of the bank, depositors have the opportunity of a one-time write-off of funds from their accounts, which can lead to the bankruptcy of even a stable bank. To counter negative factors, it is advisable to continue work on developing approaches to setting limits on withdrawals, including requirements for confirming transactions for large transfers via SMS messages, etc. The banking system not only increases the time to think over a decision but also uses mechanisms that stimulate the safety of deposits in the bank. In particular, a depositor has the right to withdraw funds, but termination of the contract leads to a decrease in the amount of income received. As a result, there is less incentive to recklessly withdraw funds from bank accounts. In addition to influencing individual decisions, government agencies also use funds fixing mechanisms. For example, in the field of shared construction, escrow accounts are used, into which the shareholder deposits funds that are available for withdrawal by the developer only after the completion and commissioning of the construction object [11]. By using a cash-saving mechanism using escrow accounts, construction funding is less prone to fluctuations due to the dynamics of the behavioral cycle.

It is necessary to understand that any restrictions on money transfers should not violate the rights of economic entities to dispose of available funds. In the event that a decision is made on their withdrawal, the subjects should be able to promptly implement the decisions taken. For this, it is advisable to continue work on the development of payment instruments that may have an impact

on economic development [12]. The low level of development of the payment infrastructure will reduce the ability of subjects with an adaptive type of behavior to quickly respond to changes in the economic situation. With the growth of uncertainty, the likelihood of irrational actions on the part of economic agents increases [13]. As a result, subjects with an adaptive type of behavior will not have time to complete economic transactions in time to preserve their savings. A similar situation, in particular, took place during the 1998 default. The problem of subjects with adaptive and reactive types of behavior having no opportunity to take actions is relevant not only for households but also for other economic entities (banks, in particular) [14]. Due to the increase in the time between the receipt of information and the performance of the transaction, actions may be taken too late that increases the potential losses of subjects with adaptive and reactive types of behavior.

CONCLUSIONS

The presented research has confirmed the impact of changes in the dominant type of behavior of economic entities on certain macroeconomic parameters. It is possible to conclude that when developing state policy aimed at ensuring the sustainability of economic development, it is necessary to consider both the dynamics of the economic and behavioral cycle. It is due to the fact that fluctuations in the behavioral cycle determine the volatility of certain macroeconomic indicators. The study demonstrates the existence of a relationship between the structure of the distribution of household income between consumption, savings, investment, and the expectations of subjects regarding the situation in the future. Thus, the behavioral cycle may act as an object of public policy related to the determination of the current phase of the behavioral cycle, as well as the development of an appropriate countercyclical policy.

The existence of a behavioral cycle is associated with the possibility of accumulating expectations of economic entities regarding the future, which is due to the influence of the previous experience of economic crises, education, and professional background. It has been established that the economic actions of subjects are influenced by the formed dominant type of behavior, as well as the prevailing macroeconomic conditions. The change in the phases of the behavioral cycle occurs due to the initial actions of subjects with an active type of behavior, as well as subsequent actions of subjects with adaptive and reactive types of behavior. The formation of the dominant type of household behavior is significantly influenced by the size of the population's real disposable income. A change in the dominant type of behavior leads to a change in the actions of subjects but the existing behavioral fluctuations are limited by the size of household budget constraints. Fluctuations in the behavioral cycle, first of all, are expressed in changes in the dynamics of the cash flow generation, which depends on the individual decisions of economic entities. In this regard, information on the volatility of cash flows, which depends on the sentiments of economic agents, may be used as a strategic indicator of changes in the phase of the behavioral cycle.

Eventually, it was found that the actions of subjects with an active type of behavior do not always lead to a change in the phase of the behavioral cycle due to insufficient impact force. The strength of the impact of subjects with an active type of behavior is determined by the phase in which the impact was carried out, as well as the presence of appropriate economic prerequisites. It seems appropriate to monitor the current phase of the behavioral cycle, as well as develop tools to reduce the incentives to perform spontaneous actions. Further research should be aimed at developing approaches to monitoring the dynamics of the behavioral cycle based on macroeconomic indicators, as well as various sociological assessments.

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Directions for Improving the Monitoring System of State Programs of Socio-Economic Development of Russia

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ABSTRACT

The significant role of the program-based and target-oriented management approach (PTM) in solving the priority tasks of the state by setting strategic goals, accumulating financial resources, and operational coordination of the activities of executives at the federal, regional, and municipal levels of government ensures the **relevance** of this research. The study **aims** to identify the key problems and areas for the financial monitoring improvement of the state programs of socio-economic development of Russia. The **methodological basis** of the paper is a systematic comprehensive approach to the study of social, financial, and economic problems, as well as general methods of scientific knowledge: sampling, grouping, comparison, generalization. The study shows that PTM practices for overcoming challenges of the Russian economy are characterized by inconsistencies that require a comprehensive approach to program-based and targeted planning, control, and monitoring system development. The research allowed us to update the special partnership model of control and accounting institutions of the modern state, its role in the development of the process of financial monitoring of state programs, and PTM tools. Based on the experience of certain regions the authors **conclude** the necessity to introduce project management, key performance indicators, digitization strategies, and remote financial monitoring practices for the activities of the control and accounting bodies. Additionally, control and accounting bodies should develop a proactive partnership model of monitoring rather than a competitive one. The authors see the **prospect** for future research in the introduction of new technologies for embedding monitoring tools into the objects control procedures implemented into business systems; preventing violations in a controlled environment; prompt response to current challenges and risks of the financial and budgetary sphere.

Keywords: state budget policy; program-based and target-oriented management; state program; expenditure budget obligations; strategic financial audit; state financial control; project financial management; partnership model of financial control

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INTRODUCTION

The introduction of a program-based and target-oriented management approach (PTM) into the public administration system actualizes the achievement not so much of traditional political goals as the constant efficiency and management transparency, the required satisfaction level of the population with the quality of services initiated and provided by the state.

Program planning in foreign countries is implemented as efficiently as possible due to considerable experience in introducing, identifying problem areas, smoothing out the consequences by the process of reorganization of the system [1, p. 114]. Thus, the United States has vast experience in program budgeting and have been applying this methodology since 1965. It has the following features:

- all program costs are defined by 19 functions;
- the current program implementation period may exceed a fiscal year;
- the program budget implementation may take up to 10 years.

The efficiency assessment of the implementation of programs is structured. The Office of Management and Budget within the Executive Office of the President of the United States plays a key role in this process [2, p. 242].

Japan has a different experience of implementing a program-based and target-oriented management approach (PTM). Establishing

large research centers, science parks, and unlocking the potential of development and production of the country is the main priority of the state policy. In addition, a feature of program planning in Japan is the key role of local authorities that adapt programs to a specific location considering its conditions. [3, p. 89].

Program-based and target-oriented management has become widespread due to a number of significant advantages:

- concentration of limited resources in the most important strategic areas;
- targeted clear orientation;
- targeted use of resources;
- complexity of measures;
- elimination of duplication of interrelated programs [4, p. 91].

GENESIS AND INSTITUTIONAL BASIS OF PROGRAM-BUDGETING IN RUSSIA

The development of complex scientific, technical, economic, and social programs as a tool of state policy, is significant for forecasting and development of macroeconomic efficiency [5, p. 23].

If we look at the origins of the PTM in Russia, the budget reform was determined by the need to achieve the goals of socio-economic development in the long term, with slow growth in federal budget revenues, and an increase in the efficiency of the functions of executive bodies of state power at various levels [6, p. 101]. The objective significance of the adoption of the Federal Law of 20.07.1995 No. 115-FZ "On state forecasting and programs of socio-economic development of the Russian Federation" in the PTM regulation, is in the formation of a conceptual base for the use of state programs (SPs) as a new management tool.

In 2004, the Ministry of Finance of the Russian Federation initiated the implementation of the performance-based budgeting (RBB) procedure, as well as the Russian Government Program to improve the efficiency of budget expenditures for the period up to 2012, approved by the relevant Government decree of June 30, 2010 No. 1101-r.

The decree of the Government of the Russian Federation of 02.08.2010 No. 588 "On approval of the procedure for the development, implementation, and evaluation of the effectiveness of state programs of the Russian Federation"[1] emphasizes the distinctive features of state programs (SPs):

1) the strategic nature of the planning document;

2) focus on the implementation of the socio-economic policy priorities and national security of the state;

3) the interconnection and consistency of tasks, planned activities, timing, performers, basic resources [7, p. 10].

In 2013, amendments were made to the Budget Code of the Russian Federation (Art. 179)[2], which secured the key status of a state program as an instrument of PTM and budgetary policy of the modern state. Currently, a new functional-target approach is being announced, which involves using features of the structure of the subject area of complex research and the adoption of appropriate decisions [8, p. 164].

The program is developed based on a preassessment, reflecting the compliance of state goals with socio-economic development [9, p. 16]. At the stage of implementation, an ongoing or process assessment takes place — monitoring aimed at adjusting the results, taking into account changing conditions, and achieved results. At the last stage, the program ends and the actual impact and final results are assessed. Basically, programs are assessed during the implementation period for goals achievement. The results of the assessment are reflected in the annual report of officials responsible for public finance according to the methodology approved by the

[1] National goals monitoring. Accounts Chamber of the Russian Federation. URL: https://ng.ach.gov.ru/ (accessed on 12.03.2020).

[2] Federal Law No. 252-FZ of 23.07.2013 "On Amendments to the Budget Code of the Russian Federation and Certain Legislative Acts of the Russian Federation" URL: http://www.consultant.ru/document/cons_doc_LAW_150289/ (accessed on 15.03.2020).

Government Decree of the Russian Federation No. 903 dated July 17, 2019 "On Approval of the Formation Rules of the consolidated annual report on the implementation and assessment of the effectiveness of government programs of the Russian Federation …".[3]

In this context, the significant role is played by the Accounts Chamber (AC) of the Russian Federation, permanent state financial control bodies at the regional and local levels in strengthening actions in the field of expertise, analysis of the implementation goals, assessment of the condition; implementation of preventive interaction based on cooperation with the relevant authorities in the field of budgetary legal relations; exchange of global audit experience; implementation of educational programs aimed at strengthening professional competencies, the formation of a "common knowledge base" of the audit professional community, creating reputation capital and increasing the transparency of activities [10, p. 45].

Thus, the monitoring of the execution of 42 approved SPs in 2019, carried out by the Accounts Chamber of the Russian Federation annually, revealed the following problems:

- lack of a clear link between the amount of financial support and program indicators (criteria);
- tendency towards the deterioration of values of some indicators;
- inconsistency of the composition of indicators, sustainable practice of their exclusion due to failure to reach the planned threshold;
- lack of a methodology for comparing the dynamics of indicators for the period of implementation of the PTP tools;
- low share of indicators of statistical observation;
- uneven distribution of expenses for some government programs [11, p. 41].

As a result of a comprehensive monitoring of the PTM tool [pilot state programs, national projects, departmental and federal target-oriented programs (DTP, FTP), priority projects (programs)], two main areas for improvement of the PTM were identified:[4]

- preparation of a single document (regulation) on the SPs' management system, within the framework of which solutions will be methodologically presented ensuring the interconnection of PTP tools in terms of content, mechanism of their creation, implementation, and follow-up reporting;
- approval of the methodology for assessing the effectiveness of state programs.

The tasks of identifying and eliminating problems, supplementing the financial audit with a comprehensive analysis of the effectiveness of the PTM tools used at the regional and local levels, analyzing the compliance of the implemented measures with modern challenges of strategic management and national security criteria [12, p. 209].

REGIONAL AND MUNICIPAL ASPECTS OF THE IMPLEMENTATION OF PROGRAM-BASED AND TARGET-ORIENTED MANAGEMENT IN RUSSIA

For the purpose of operational control over revenues management and expenditure obligations of the regional budget, budgets of territorial extra-budgetary funds in terms of volume, structure, purpose, and the implementation of audit functions of tax and budget legislation compliance, local governments have updated the activities of the state financial control body — the Chamber of Control and Accounts (CCA) of the Volgograd region.[5]

Justifying the importance of the PTP in regional development, we note that the socio-

[3] Government Decree of the Russian Federation of 02.08.2010 No. 588 "On approval of the Procedure for the development, implementation, and evaluation of the efficiency of state programs of the Russian Federation." URL: http://docs.cntd.ru/document/902228825 (accessed on 20.05.2020).

[4] Consolidated analytical report on the implementation of the federal budget and budgets of state extra-budgetary funds of the Russian Federation. URL: http://audit.gov.ru/promo/analytical-report-federal-budget-2019–4/index.html (accessed on 15.03.2020).

[5] Monitoring activities. Chamber of Control and Accounts of the Volgograd Region. URL: http://ksp34.ru/activity/control_measures/2018_god22/ (accessed on 20.03.2020).

economic situation of the Volgograd region is determined by achieving goals in nine key areas:

- population growth;
- increase in life expectancy;
- growth of income and pensions;
- reducing the level of poverty;
- improvement of living conditions;
- acceleration of technological development;
- digital technologies;
- economic growth;
- development of exports [13, p. 153].

23 SPs are being implemented in these areas in the Volgograd region. The volume of funds provided by the regional budget is presented in *Table. 1*.

Table. 1 shows the ambiguity of the dynamics of financing of programs: in 2017–2018 — an increase, in 2019–2020 — a decrease in the total amount of regional funds. A smaller amount of funds allocated for the state programs "Health care development in the Volgograd region"; "Health and safety in the Volgograd region"; "Sustainable rural development" and 8 more significant programs, which, however, is not related to the efficiency of their implementation.

It should be noted that none of the 23 programs is characterized by satisfactory or unsatisfactory implementation efficiency (Ie_{sp}). However, among programs with an efficiency indicator exceeding 100% (above-target indicators), there are some instruments with average efficiency and those on the edge of satisfactory assessment.

The analysis made it possible to distinguish 6 programs with an average efficiency of implementation (30% of the total): "Culture and tourism development in the Volgagrad region" (Ie_{sp} = 88%); "Environmental protection in the Volgograd region (Ie_{sp} = 86.81%); "Energy conservation and energy efficiency in the Volgograd region" (Ie_{sp} = 85.7%); "Health care development in the Volgograd region" (Ie_{sp} = 83.72%); "Sustainable rural development" (Ie_{sp} = 82,72%); "Crime prevention and public safety on the territory of the Volgograd region" (Ie_{sp} = 81%). "Crime prevention and public safety in the Volgograd region" program has low efficiency due to the lack of two target indicators:

- "Number of registered crimes" indicator exceeded the plan by 491 points (unemployment and low-paid jobs are socio-economic factors in the growth of street crime);
- "Ratio on the number of protocols on administrative offenses drawn up by officials of the internal affairs bodies to the total number of protocols on administrative offenses" indicator was 0% with a plan of 40%[6] (failure to agree on the delegation of authorities to the Ministry of Internal Affairs of Russia, lack of funding). Thus, the main contractor is ineffective in fulfilling its obligations.

The reason for the decrease in the efficiency of the implementation of the program may be the "extra-program" part of the activities of the responsible executive body: the regional committee, in disposing of the property, bears the cost of paying tax on the property of organizations and transport.

The largest total amount of financing (493.3 billion rubles) is allocated for the SP "Health care development in the Volgograd region". Certain performance indicators and results of the implementation of the measures of this state program significantly exceeded over several budget periods. However, while financing the state program at the expense of the regional budget in the amount of 99.98% of the approved budget allocations, the profile executive committee did not meet 11 performance indicators (12.6% of the plan), activities for 6 programs did not take place (15.8% of the plan), which proves inaccuracies both at the planning stage of the program and the inefficiency of the implementation and use of budget funds.

In the administrative center of the region — in Volgograd — 22 programs are being implemented, including 15 municipal pro-

[6] Report on the implementation of the program "Crime prevention and public safety in the Volgograd region." URL: http:// kdnk.volgograd.ru (accessed on 21.03.2020).

Table 1

Dynamics of the volume of financing of state programs from the budget of the Volgograd region in 2017–2020, thousand rubles

Indicator	2017	2018	2019	2020
Program budgeting, including:	67781672.55	74176595.63	76251283.05	76504508.63
Education development in the Volgograd region	20467097	21478197	22450391	23575574
Regional youth policy of the Volgograd region	93141.3	109047.9	91618.7	142907.9
Health care development in the Volgograd region	15555866	17796310	16949225	16698945
Civil society development in the Volgograd region	45120.9	48150.9	68022.1	35831.7
Social assistance and protection in the Volgograd region	10103017	11918003	13096204	12496497
Health and safety in the Volgograd region	1231200	1808903	1178964	1102395
Transport system development and road safety in the Volgograd region	7119308	6066190	8088349	9302337
Labor market development and employment in the Volgograd region	250044.1	273005.4	274827.6	257045.4
Use, water resources and water pollution control on the territory of the Volgograd region	246663.2	158969.5	325592.3	436494.6
Environmental protection in the Volgograd region	197690.1	343387.6	388504.6	287841.8
Agriculture development and regulation of markets for agricultural products, raw materials and food	656259.2	885836.2	978753.3	1010000
Sustainable rural development	413679.9	481915.5	227668.6	423332.4
Physical training and sports development in the Volgograd region	874289.7	1414934	1102376	1229319
Economic development and innovative economy	382135.6	897391.2	972194.2	890559.9
Public finance management of the Volgograd region	6768160	6029872	5774955	5542931
Energy conservation and energy efficiency in the Volgograd region	1001703	606840.3	336568.9	88827.53
Information society development of the Volgograd region	131341.1	239312.5	209636.8	184411.2
Industrial development of the Volgograd region and its competitive potential	0	0	0	0
Development of culture in the Volgograd region	1151438	2109080	1643324	1375830
Provision of affordable and comfortable housing and utilities for residents of the Volgograd region	958773.5	856265.3	1493576	877877.9
Crime prevention and public safety on the territory of the Volgograd region	63792.1	83643.7	66908.3	66708.3
Modern urban environment development of the Volgograd region	0	414705.9	357981.4	384011.5
Development of tourism in the Volgograd region	70953.6	156634.1	175643.2	94831.3
Share in the total regional budget, %	58.23	60.00	59.70	56.81

Source: Resolution of the administration of the Volgograd region «On approval of the list of state programs of the Volgograd region and on invalidation of certain resolutions of the administration of the Volgograd region» от 11.10.2016 № 557-п. URL: http://docs.cntd.ru/document/441767922 (accessed on 20.04.2020).

grams, 7 departmental target programs. The total funding of municipal programs from the budget of the city of Volgograd in 2019 amounts to 5,175,001 thousand rubles, including: "Education development on the territory of Volgograd" — 50.5%; "Culture development of Volgograd" — 15.8%; "Maintenance and development of the road network of Volgograd and ensuring the efficient operation of the transport infrastructure of Volgograd" — 12.1%.[7]

The analysis of the implementation of municipal programs in Volgograd made it possible to identify the following main problems:

- the imbalance between the assessment of efficiency and the level of costs for their implementation for individual municipal programs;
- a number of indicators of municipal programs are not confirmed by indicators of municipal goals, which also does not allow assessing the validity of the achieved results and their relationship with the invested budget funds;
- inconsistency in the volume of funds established in datasheets and budget planning (municipal programs "Formation of a modern urban environment", "Housing construction", "Maintenance and development of the Volgograd highway network and ensuring the effective functioning of Volgograd's transport infrastructure");
- a non-fulfillment of funds from the city budget in full due to the financing of program activities within the total forecast of cash payments, communicated to the main managers of budgetary funds of the Volgograd administration, based on the forecast indicators of budget revenues in the Volgograd budget. The ratio of funds provided in the Volgograd budget in 2018 and funds spent on the implementation of program activities is presented in the *Table. 2*.

Out of 15 municipal programs, the smallest percentage of implementation was noted for the following programs:

- "Physical training and sports development in the Volgograd region" (94.6 and 88.7%, respectively);
- "Volgograd culture development" (respectively, 95.9 and 95.9%);
- "Youth policy development, events for children and youth in Volgograd" (respectively 96.1 and 96.1%).

The datasheet analysis, as well as reporting data of managers responsible for budget funds for all programs implemented in the region and its municipality, revealed some systemic problems:

1. A lack of funding identified at the stage of program implementation. In the analyzed programs of the Volgograd region, a lack of funds is one of the reasons for not meeting the target. Thus, the implementation of the planning document "Social assistance and protection of the population in the Volgograd region" was accompanied by non-fulfillment of four measures, explained by the lack of appropriations in the budget statement, as well as failure to achieve two indicators of the subprogram "Barrier-free environment for disabled people and physically challenged people" to an incorrect list of resource provision of the document. The costs planned at the expense of local budgets for the implementation of the subprogram "Barrier-free environment for disabled people and physically challenged people" are 100% fulfilled, and the financial support of this subprogram was not at the expense of unitary enterprises. Given that social policy is a priority in the distribution of state allocations, it is necessary to carefully approach the procedure for developing programs, to intensify the search and implementation of new organizational foundations and financial instruments aimed at implementing and developing a targeted approach in the system of social protection of the population [14, p. 56].

2. A significant problem in terms of completeness is the redundancy of indicators, the

[7] Decree of the Volgograd Administration «On approval of the List of municipal programs proposed for implementation (being implemented) on the territory of Volgograd» dated December 29, 2018 No. 1863. URL: http://docs.cntd.ru/document/550317956 (accessed on 21.05.2020).

Table 2

The ratio of funds allocated to the budget of the city of Volgograd in 2018 and funds spent on the program implementation activities, million rubles

Approved for 2018				Executed on 01.01.2019	Including funds		Completion, %
By programs	In budget	Including funds			Volgograd budget	higher-level budgets	
		Volgograd budget	higher-level budgets				
Total by programs							
18878.51	18811.26	6865.82	11945.44	18334.65	6526.79	11817.86	97.5
Total by municipal programs							
16942.77	16876.18	5415.17	11461.00	16427.83	5076.35	11351.48	97.3
Total for departmental target programs							
1935.74	193508	1450.65	484.43	1906.82	1440.44	466.38	98.5

Source: Summary report on the results of the implementation of municipal programs and departmental target programs with an assessment of their implementation effectiveness for the entire validity period. Official website of the Volgograd Administration. URL: http://www.volgadmin.ru/d/opendata/index (accessed on 15.07.2020).

multiplicity of target indicators of individual SPs. In particular, according to the subprograms "Sustainable rural development", "Modern urban environment development in the Volgograd region", "Health care development in the Volgograd region" the number of planned performance indicators reach 18 up to 22, while 15 or more tasks may be assigned to the direct executor for each indicator. Objectively, practical verification and monitoring of the achievement of "hundreds of indicators|" is not used to assess efficiency. Actions on a reasonable array of related indicators within the framework of an open, understandable, transparent key methodology are recognized as rational.

3. Unrealistic goals, leveling of essential grounds, and implementation risks. Thus, in the volume of planned funds, additional resources are not taken into account, which excludes a positive effect on a number of activities. The analysis of the report on the implementation results of the program "Labor market and employment development in the Volgograd region" shows that the event "Provision of state services for the organization of temporary employment of minors aged from 14 to 18 years in their free time from school" in terms of wages directly depends on the volume of regional budgetary funds, reflected in the datasheets of the SP, and on the employers' resources not accounted for in the program [13, p. 157].

4. The impossibility of changing the financial support of the state program, adjusting the planned results according to the volume of the budget allocations (in particular, the Procedure for the development, implementation, and evaluation of the implementation efficiency of the state programs of the Volgograd region No. 423-p). At the federal level, however, such an opportunity is established in the Decree of the Federal Government dated 02.08.2010 No. 588.

COMPARATIVE ANALYSIS OF THE IMPLEMENTATION OF PROGRAM-BASED AND TARGET-ORIENTED MANAGEMENT AT THE REGIONAL AND MUNICIPAL LEVEL

To confirm the objectivity and consistency of the aforementioned problems, we use a comparative analysis to assess the quality of the PTM and its monitoring on the territory of another subject of the Southern Federal District (SFD) — Rostov Region, where funding is distributed according to 22 state programs. Based on the data of the Ministry of Economic Development of the Rostov Region, grouped in *Table. 3*, we note a significantly greater SPs' execution dependence on the resources of the regional budget in comparison with the Volgograd region, as evidenced by the indicators of both the specific weight and the absolute value of funding.

Out of 22 programs, 6 programs have an average level of efficiency: "Education development" (Ie_{sp} = 0.89); "Environmental protection and rational use of natural resources" (Ie_{sp} = 0.87); "Physical training and sports development" (Ie_{sp} = 0.89); "Transport system development" (Ie_{sp} = 0.85); "Agriculture development and regulation of markets for agricultural products, raw materials and food" (Ie_{sp} = 87); "Modern urban environment in the Rostov region" (Ie_{sp} = 0.85).

Among the main factors of negative impact on the implementation of the SPs in the region, identified as a result of their monitoring by the CCA of the Rostov region, we note:

1. A lengthy document processing procedure that prevents the achievement of target indicators within the specified time frame (this factor influenced 50% of these programs with an average efficiency).

2. Unsatisfactory work of contractors associated with non-fulfillment of the terms of contracts.

3. Incomplete work due to exceeding the deadline for the implementation of control measures of the established reporting period (to reflect the actual deadlines, a revision, or reduction in the number of performance indicators is required).

4. Unaccounted factors of exogenous events, in particular those associated with natural forces ("Environmental protection and rational use of natural resources", "Agriculture development": the consequences of a large forest fire prevented the implementation of a number of programs; unfavorable weather conditions during the growing season and harvesting influenced the gross yield decrease).[8]

In turn, at the municipal level — in Rostov-on-Don, 22 municipal programs are being implemented, with total funding of 32,844,314 thousand rubles from the city budget. The most capital-intensive programs are: "Development of the education system of Rostov-on-Don" 14,906,569.2 thousand rubles. (45.4%); "Social protection of the population of Rostov-on-Don" 6,216,498.1 thousand rubles. (18.9%); "Development and operation of transport infrastructure and passenger transport in Rostov-on-Don" 3,538,835.6 thousand rubles. (10.8%).[9] The main problem in the implementation of municipal programs is the failure to comply with the order and terms of planning and implementation of the municipal task.

Thus, there are various factors that reduce the efficiency of the Volgograd and Rostov regions, representing the Southern Federal District and implementing the PTP in the regional management system. At the same time, these are permanent factors that require a reduction in the formal planning (forecasting), execution and monitoring procedures. It is emphasized that a methodologically competent assessment of the efficiency of programs, high-quality monitoring by the control, and accounting bodies should become a tool to

[8] Rostov region in figures: brief review. URL: https://rostov.gks.ru/storage/mediabank/maket!2018.pdf (accessed on 19.03.2020).

[9] Municipal programs. Official website of the City Duma and the municipal government of Rostov-on-Don URL: https://rostov-gorod.ru/administration/structure/departments/deg/action/mp-goroda/per-mun-progg.php?special_version=Y (accessed on 10.07.2020).

Table3

Dynamics of the volume of financing of state programs from the budget of the Rostov region in 2017–2020, thousand rubles

Indicator	2017	2018	2019	2020
Program budgeting, including:	136 140 883.2	152 967 284.5	159 004 202	152 768 712.3
Economic development and innovative economy	1 217 706.366	1 368 209.4	1 368 209.4	1 368 209.4
Energy efficiency and industrial and energy development	177 627.09	199 581	199 581	70 499.6
Transport system development	13 784 477.35	15 488 176.8	15 488 176.8	15 951 693.6
Agriculture development and regulation of markets for agricultural products, raw materials and food	7 065 080.236	7 938 292.4	6 302 096.5	6 314 881.1
Information society	484 903.506	544 835.4	736 220.4	526 623
Territorial planning and affordable and comfortable housing for the population	3 076 646.251	3 456 905.9	4 671 323.4	3 499 263.7
Provision of high-quality housing and public utility services	6 236 675.178	7 007 500.2	3 932 923.4	2 675 593.1
Modern urban environment development	1 586 873.827	1 783 004.3	1 441 484.4	1 455 402.6
Environmental protection and rational use of natural resources	529 181.095	594 585.5	641 279.7	529 585.5
Promotion of employment of the population	530 304.186	595 847.4	595 827.3	595 847.4
Social assistance of citizens	25 729 746.48	28 909 827.5	34 205 472.7	35 047 148.8
Accessible environment	9698.775	10 897.5	106 772.8	85 075.9
Health care development	22 107 500.41	24 839 888.1	28 929 063.7	29 531 083.7
Physical training and sports development	4 618 562.885	5 189 396.5	2 766 783.7	2 077 305.6
Education development	35 751 795.2	40 170 556.4	42 824 424.3	40 552 001.2
Culture and tourism development	3 274 663.241	3 679 396.9	3 784 416.5	2 190 465
Youth of the Rostov region	81 116.825	91 142.5	91 142.5	91 142.5
Support for Cossack communities	671 488.802	754 481.8	778 853.7	768 607.7
Public order and crime prevention	76 220.223	85 640.7	109 828	112 837.2
Protection of the population and territory from emergency situations, ensuring fire and water safety	1 092 486.303	1 227 512.7	746 820	741 902.3
Regional policy	152 010.398	170 798.2	170 818.3	170 798.2
Public finance management	7 886 118.586	8 860 807.4	9 112 683	8 412 745.2
Share in the total regional budget, %	73.04	80.2	75.93	72.71

Source: Current activity. Ministry of Economic Development of the Rostov region. URL: https://mineconomikiro.donland.ru/activity/3386/ (accessed on 17.03.2020).

stimulate the effective activities of responsible executors at all stages of the implementation of the SPs.

PROSPECTS FOR MONITORING OF STATE PROGRAMS BY THE CONTROL AND ACCOUNTING BODIES

The basic task of programming as a form of state regulation of the economy is the maintenance of economic equilibrium, influencing qualitative changes in the economy, and stimulating its development [15, p. 38]. Therefore, the above-mentioned problems of SPs of two regions show the importance of assessing the state of monitoring of strategic projects in the country, control issues at the federal level, projected at the regional level, threaten the overall achievement of key objectives and expected results of the national projects. In this context, the Accounts Chamber of Russia recognized the following issues as systemic:

1. Established national goals are not always linked with national projects, project objectives do not lead to the achievement of the set goals. The auditors note that the achievement of the goals for some strategic documents is impossible due to the fact that the financing of the programs includes extra-budgetary funds, and in fact, mechanisms for attracting, justifying, and detailing the sources of extra-budgetary funds have not been created [16, p. 275]. Thus, the national project "Science" directly depends on funding from extra-budgetary funds, which are not guaranteed: in the total amount of funding, the share of extra-budgetary funds is on average 36% in 2019–2024, and by 2024 it should exceed 50%.[10]

2. Low level and quality of interaction between federal and regional executive authorities in solving issues of implementation of national projects. The generated key indicators often do not take into account the resource potential and the potential of the subjects. The absence of an effective methodology for the application of performance indicators and indicators for regions to avoid their non-fulfillment or distortion was noted.

3. Research of the datasheets of some national projects, analysis of documents — reports on the progress of their implementation showed the insufficiency and subjectivity of information about the risks arising on the way to achieving the main goals. There is a risk of untimely provision for spending funds, the risk of insolvency of measures related to the conclusion of agreements (contracts) in the framework of the implementation of federal projects, a national project at the level of a constituent entity of the Russian Federation.

We note that according to the reporting documents as of November 1, 2019, issues of underfunding were identified, as well as financing imbalances (for example, during the implementation of the national project "Education" in 2016–2018 more than 70% of the budget was spent on payments — wages of workers and only 1.7% was spent on the purchase of equipment and major repairs as part of education development).[11] For the national project "Labor productivity" it is planned to attract more than 10 thousand enterprises but at the same time, most companies need to independently achieve the goals of the program.

4. Imperfection of the technical base of the system for monitoring and control of the implementation of the PTM: information is often aggregated manually and arrives after the established deadlines, that determines difficulties in analyzing and monitoring the process, complicates decision-making on adjusting and minimizing risks in the implementation of national projects.

5. It is noted that performance indicators have nothing in common with the realities of citizens' lives; their declaratives, generality, which enhances the importance of adjustments with the allocation of key indicators

[10] The Federal Treasury budget. Approaches to the digitalization of control in the financial and budgetary sphere. URL: https://roskazna.ru/upload/iblock/81d/isaev_05_2019.pdf (accessed on 21.03.2020).

[11] Results of the implementation of national projects. RBC Group. URL: https://www.rbc.ru/economics/13/01/2020/5e184e2a9a79470bf49655c3 (accessed on 17.03.2020).

that have the highest priority in each region, and the development of directions for improving the quality of their implementation.

6. Finally, in the current context of restrictive measures to counter the spread of the disease (COVID-19), the achievement of the planned results (indicators) of development programs is under threat. A widespread of the disease has revealed a serious problem of the lack of open operational adjustments to government programs at the federal and especially regional levels.

The coronavirus pandemic has shifted the national planning horizon (from 2024 to 2030) and updated the revision of the implementation of national goals and projects. Thus, some national development goals of the country have been reduced from nine to five. The possibility of including a federal project on combating infectious diseases in the national project "Health" is being considered. However, national projects in 2020 will receive a total of 200 billion rubles to finance the program to support the economy amid the coronavirus epidemic less discharge. More than others, the costs of the national project for the digitalization of the economy and export support are being reduced. Also, it is confirmed that the annual funding of national projects will take place until 2030.

The letter of the Ministry of Finance of Russia dated 06/08/2020 No. 16–08–04 / 49210 confirms large adjustments of a number of state programs.[12] Two trends should be noted: an increase in funding for programs aimed at economic and technological development or focused on industries affected by the coronavirus epidemic, and a cutting of allocations for the sectors least affected by the pandemic. Thus, it is proposed to increase budget allocations for the program "Social assistance of citizens". In 2021, expenses may grow by 43.7 billion rubles, to 1.89 trillion rubles, in 2022 — by 33.9 billion rubles, to 1.98 trillion rubles, and in 2023 — by 188 billion rubles, to 2.1 trillion rubles. On the contrary, spending on the implementation of the state arms program will be cut by 5% in 2021–2023 (by about 323 billion rubles). Expenditures for the energy sector development, the transport system and the nuclear power and industrial complex are also planned to be reduced by 3.64 billion rubles, by 331.75 billion rubles and by 67.45 billion rubles respectively, for three years in total.

At the same time, there are few documents proposing adjustments to existing state programs.

Thus, the Resolution of the Government of the Russian Federation No. 375[13] introduces changes in the goals of the state program "Agriculture development and regulation of agricultural products, raw materials, and foods" for 2020–2025, as well as in Appendix 5. A decrease in incomes of the population, restrictive measures taken by other countries in connection with the spread of the virus (supply chain disruption), as well as the rise in production costs, highlighted the need to adjust the planned index values of livestock production and, accordingly, the index of agricultural production in farms of all categories (in corresponding prices). Changes in the state program "Argo-industrial complex" provide for the adjustment of the added value created in agriculture from 5.77 to 4.56 trillion rubles by 2025 (–21%). By the end of 2020, the indicator is expected to decrease from 4.05 to 3.13 trillion rubles (–22.5%). As a result of the pandemic, there was a decrease in investment in fixed assets of the agricultural sector. The initial version of the state program for the

[12] Letter of the Ministry of Finance of Russia dated 06/08/2020 No. 16–08–04 / 49210 "Draft methodology for calculating the maximum base budget allocations of the federal budget for state programs of the Russian Federation and non-program areas of activity for 2021 and for the planning period of 2022 and 2023". URL: https://minfin.gov.ru/ru/document/?id_4=130317-pismo_minfina_rossii_ot_08.06.2020__16–08–0449210_proekt_metodiki_rascheta_predelnykh_bazovykh_byudzhetnykh_assignovanii_federalnogo_byudzheta_po_gosudarstvennym_programmam_r (accessed on 27.08.2020).

[13] Resolution of the Government of the Russian Federation of March 31, 2020 No. 375 "On Amendments to the State Program for the Development of Agriculture and Regulation of the Markets of Agricultural Products, Raw Materials, and Foods". URL: https://base.garant.ru/73841082/ (accessed on 27.08.2020).

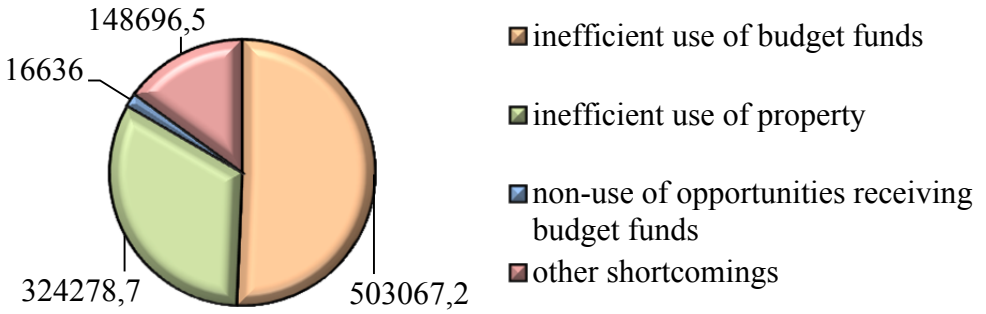

Fig. 1. **Shortcomings of the authorized bodies implementing budgeting activities in 2018, thousand rubles**

Source: Decision of the Board of the Control and Accounting Chamber of Volgograd "Formed report on the activities of the Control and Accounting Chamber of Volgograd in 2018" от 19.04.2019 № 6/2. URL: http://www.kspvolg.ru/d/activities/reports (accessed on 18.03.2020).

development of agriculture and regulation of agricultural products, raw materials, and food markets, assumed that investments would increase by 21.8% from 2017 to 2025. At present, the planned reduction is 0.1% (excluding small business). In 2020, the figure will be 92.5% instead of the projected 107.7%.

In other cases, the situation was popularized when more complete information on the impact of the COVID-19 pandemic on the economic situation, and PTM will be presented in annual reports of the responsible budget administrators.

Having highlighted the significant problem areas for the implementation of the PTP at the federal and regional levels, emphasizing the priority of the development of the activities of control and accounting bodies in general and at the local level, we will highlight the following areas for improving monitoring and current control of the implementation of the SP:

1. Improving strategic audits at the federal and regional levels. A strategic audit is focused on improving the quality of strategic documents at the stages of planning, adjusting planning documents, monitoring and control, analyzing current and final public results by sectors and areas of activity: determining not only targeted and inappropriate spending of budget money but also assessing risks and implementation effectiveness of development programs; identifying gaps in legal regulation, methodological support, inspection arrangements, ensuring the transparency and accessibility of the information resource [17, p. 13].

At the beginning of 2020, the result of the strategic audit of the achievement of performance indicators of federal executive bodies (FEB), conducted by the Accounts Chamber of Russia, was established inefficiency of the existing planning system:

- out of 525 indicators of national and federal projects, 236 (45%) are not included in the measures (FEB);
- out of 1263 indicators of state programs and subprograms, 935 (74%) are not included in the plans of federal executive bodies, which: allows them, at their discretion, to include or not to include certain indicators of the Accounts Chamber of Russia and national projects (programs) in their own performance indicators; negatively affects the implementation of these programs and projects; reduces the objectivity of assessing the effectiveness of federal executive bodies;
- the methodological basis for setting objectives and indicative indicators of the activities of the federal executive body requires adjustment;
- there are no methods for analyzing the impact of the activities of federal executive bodies on the performance indicators of national projects;
- federal executive bodies' plans for 2019–2024 developed and approved in two forms differ significantly in structure;

• cross-departmental interaction has not been established; the time intervals for planning in ministries and their subordinate bodies, often do not coincide, there is no mechanism for strategic and current planning;

• the mechanism for collecting feedback from society on satisfaction with the results of the activities of the federal executive power has not been established;

• a high level of annual failure to achieve planned values of performance indicators of federal executive bodies.[14]

A promising result of the implementation of the main direction of the AE RF in the field of a strategic audit should be recognized as the functioning of a multi-level system of independent and alternative monitoring and evaluation of the achievement of national goals and the implementation of national projects.

On the territory of the Volgograd region, in Volgograd, in particular, a full-fledged movement towards the development of financial audit, efficiency audit, and use and strategic audit on the basis of an analytical function is carried out by the Control and Accounts Chamber, emphasizing its function as a strategic partner in the management of local governments within the Development Strategy for 2018–2024.[15] One of the indicators of the implementation of the strategy of 2018 is the assessment and accounting of the ineffective activities of officials and organizations, leading to negative consequences for the budget (*Fig. 1*).

It should be noted that shortcomings worth a total of 992,678.4 thousand rubles were identified. The Volgograd CCA expanded the monitoring area: it is not only an analysis of budget execution and the compliance of actual costs with planned ones but also an inclusion of a strategic aspect of spending funds, which can be fully used for the economic and social development of the municipality.

Additionally, there is the following plan:

• a comprehensive assessment of the strategic planning documents of Volgograd (strategy of socio-economic development until 2030, forecast of socio-economic development of Volgograd, general plan of the Volgograd, municipal programs) for their compliance and with strategic documents of upper levels (regional, federal);

• coordination of the adopted municipal programs and draft municipal legal acts with the strategic planning documents of Volgograd within the framework of the financial and economic expertise;

• development of proposals for the adoption of the necessary regulatory legal acts governing the activities of local government bodies for the implementation of strategic documents of Volgograd;

• development of proposals to reduce the risks of failure to achieve the objectives of the municipal component of regional projects and to increase the efficiency of spending budget funds.

2. Further implementation of project management in the activities of regulatory bodies. Based on the Accounts Chamber of Russia Strategy for 2018–2024 presented in the Strategy, directions of development, its program of projects should be coined, which will ensure the effective synchronization of projects with each other in terms of their technological relationship, resource availability, and implementation timeframes. The first project implemented by the Accounts Chamber[16] — Independent monitoring and evaluation of the achievement of national goals; second — Digital transformation of the Accounts Chamber.

On the territory of the Volgograd Region, project activities are being introduced to implement national projects in accordance with

[14] Strategic audit of the setting and achievement of performance indicators of federal executive authorities. Accounts Chamber of the Russian Federation. URL: http://www.ach.gov.ru/checks/9657 (accessed on 17.03.2020).

[15] The decision of the Board of the Control and Accounts Chamber of Volgograd dated September 25, 2018 No. 27/9 "Development Strategy of the Control and Accounts Chamber of Volgograd for 2018–2024". URL: http://www.ach.gov.ru/checks/9657 (accessed on 17.03.2020).

[16] The main activities of the Accounts Chamber of the Russian Federation: Minutes of April 23, 2019 No. 16K (1312) (approved by the Board of the Accounts Chamber of the Russian Federation). URL: http://www.consultant.ru/document/cons_doc_LAW_325709/ (accessed on 19.05.2020).

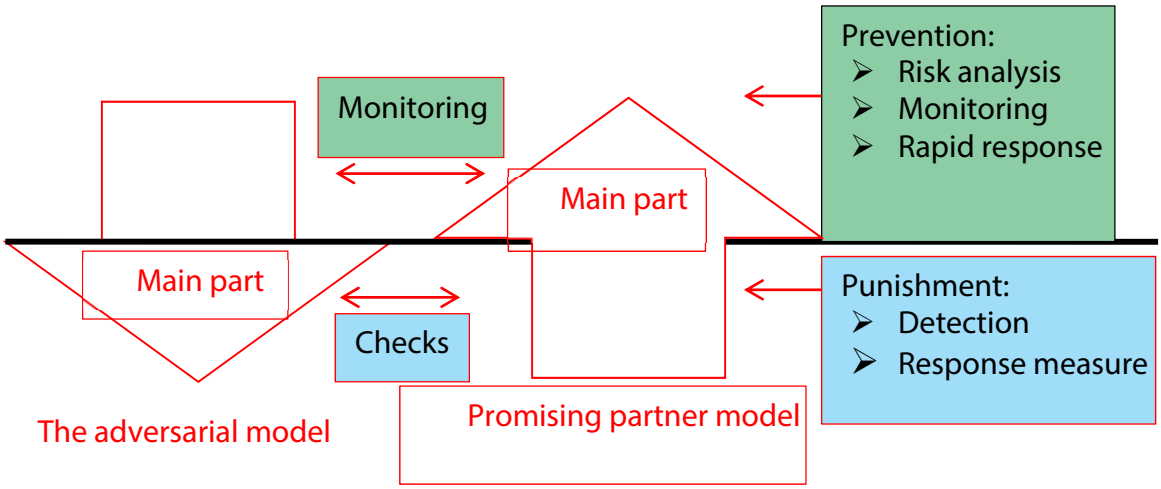

Fig. 2. **Differences between competitive and promising partnership financial control models**

Source: Development strategy of the Accounts Chamber of the Russian Federation for 2018–2024: protocol dated 23.04.2019 No. 39K (1260) (approved by the Accounts Chamber Board of the Russian Federation). URL: https://old.ach.gov.ru/about/document/СП-стратегия-А5%20русский.pdf (accessed on 21.03.2020).

the resolution of the Regional Administration dated March 26, 2019, No. 136–p.[17] Within the framework of this document, regional project implementations monitoring has been established, including the calculation of deviations of the actual parameters from the planned ones, assessment of the reasons for deviation, forecasting the stages of project implementation, making management decisions to determine, agree and take possible corrective actions. At the municipal level, in 2018, the Regulation on the organization and management of project activities in CCA of Volgograd was approved.

3. Further implementation of the system of key performance indicators (KPI) as the main mechanism for assessing the achievement of the goals and objectives of the strategy of control and accounting bodies, which is reflected in the main areas of activity of the Accounts Chamber of Russia for 2019–2021. Based on the KPIs, the Accounts Chamber of Russia, and its regional institutions should analyze and prepare proposals for changing the tested industries.

4. Digitalization and remote inspections.[18] It includes the use of information technology, which makes it possible to replace office and on-site inspections with remote ones, due to the ease, safety and economy of the processes carried out.

Since 2018, an automated system "Unified Project Environment" has been operating to collect, process, and accumulate data. In 2019, the practice of using digital tools and analytical showcases for data visualization and analysis was updated.

In this direction, the CCA of the Volgograd region and the city of Volgograd launched a digital transformation associated with the automation of individual processes, the creation of its own financial control module integrated into the information systems (databases) of the city and region, the spread of the remote inspection method (access to the AIS city and regional administration), the use of the project management information system, participation in the Volgograd region project on the digital transformation of local governments. At the same time, regional financial control, through

[17] Resolution of the Administration of the Volgograd Region dated 26.03.2019 No. 136-p "On the organization of project activities in the Administration of the Volgograd Region in the implementation of national projects and priority projects of the Volgograd Region." URL: http://docs.cntd.ru/document/553220408 (accessed on 19.07.2020).

[18] Conducting remote audits using unified information and analytical systems. Information letter of the Accounts Chamber of the Russian Federation.URL: http://www.ach.gov.ru/upload/iblock.pdf (accessed on 21.07.2020).

digitalization, is moving from a competitive to a partnership model from responding to violations to preventing them (*Fig. 2*).

This model establishes new control mechanisms into the activities of objects, when the controller becomes a part of the ongoing processes, creating a profitable partnership, responding promptly to possible risks, permanently preventing possible violations. The partnership model assumes the unification of the results of the work of all financial control bodies and the creation of a digital twin (an image of the object of control based on available information) [18, p. 13]. Regular and systematic monitoring of the territory and its facilities is carried out without taking control measures, which significantly reduces the costs of the controlling body and makes it possible to automate not only risk-oriented processes but also the mechanism of punishment in case of an offense. Since 2019, the Federal Treasury has been introducing automation into control systems and is gradually reorienting its work towards preventing violations. The possibility of amending the Budget Code of the Russian Federation is being considered so that other regulatory bodies, including the control and accounting bodies of the regions, can gain access to state analytical data of the objects of control.

CONCLUSIONS

This study has underlined a number of conclusions.

Comprehensive, constantly methodically developing monitoring of state programs is recognized as an indicator of the effectiveness of the implementation of the program-based and target-oriented approach, effective management of the regional socio-economic system.

An analysis of the current system of state strategic planning in Russia showed its imbalance, insufficient normative regulation and methodological support, imperfection of control and executive discipline, low operational orientation towards achieving national goals, lack of transparent and accessible information, which required its improvement.

Acting as an active subject of the comprehensive development of advanced standards, methods, and technologies of public administration, audit and control, accounting bodies should develop a proactive partnership model of monitoring rather than a competitive one, based on financial control instruments, efficiency audit, strategic audit, project management, digitalization, and remote data analysis, ensuring the fastest possible response to emerging problems and risks.

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Investments in the Sharing Economy and their Impact on the Employment Structural Changes

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ABSTRACT

The article examines topical issues related to structural changes in employment in the Russian economy, due to the intensive development of the sharing economy. The **aim** of the study is to systematize disparate knowledge in assessing the impact of investments in the sharing economy on the employment structure, providing an understanding of the labor market, which is influenced by transformation processes in consumption patterns and factors of digitalization of the economy, as well as to develop recommendations for improving state policy in the field of employment. Based on the **methods** of theoretical research (analysis and synthesis, generalization), the authors reviewed scientific literature and information from various sources, identified the main elements characterizing the model of collaborative consumption, considered by various researchers and online platforms. The study highlights the scientific concepts and approaches to the definition of the sharing economy, including the concept of a shared economy; collaborative economy as well as access-based consumption (to resources); network interaction; commercial exchange systems. The **novelty** of the study lies in the fact that the authors show how investments in the further development of the infrastructure of the sharing economy, including the development of digital online platforms, lead to an increase in the number of employers and workers by removing barriers and reducing transaction costs. The authors propose **recommendations** for solving employment issues: to form a system for measuring the sharing economy and accounting for it in official statistics; provide a regulatory framework for the functioning of digital platforms; ensure the privacy of personal data and the safety of citizens participating in the sharing economy. It was **concluded** that the implementation of the proposed measures will have a positive impact on the Russian labor market and increase the investment attractiveness of the most important sectors of the sharing economy.

Keywords: sharing economy; labor market transformation; investments; employment; innovations; professions of the future; structural changes; Russian economy

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INTRODUCTION

Currently, the issues of digitalization of the economy and key processes in the social sphere have given a new impetus to further research of the sharing economy, including debatable ones. At the same time, new models for business processes and collaborative consumption of goods are under discussion. The sharing economy, as well as the platform economy, the system of organizational, economic and social relations arising between entities in the process of temporary use of goods and services are an important direction for scientific research. The major issue of regulation, monitoring and evaluation of the main processes of the sharing economy is that it covers various industries and activities and does not fit easily inside official classification schemes, such as the European Nomenclature of Economic Activities (NACE), the Russian OKVED, and others functionally organized systems. According to the foreign authors (Christophe Degryse, 2016; Katre Eljas-Taal, Neil Kay, Lucas Porsch, Katarina Svatikova, 2018), typical economic variables such as income, revenue and employment are difficult to trace because digital online platforms are able to spread supply across an array of small-scale non-professional providers [1, 2].

LITERATURE REVIEW

The literature provides different definitions for the "sharing economy", however, there is no clear single concept. The authors defined the following as its main concepts:

- sharing economy;
- collaborative economy;
- access-based consumption;
- networking;
- commercial sharing systems;
- cooperative economy;
- peer-to-peer economy.

The scientific review of research shows the significant interest in the sharing economy in recent years. It is also confirmed by the trends in the number of publications on the sharing economy in eLibrary and Scopus *(Fig. 1)*.

Table 1 presents the summary of the key scientific concepts and approaches to the "sharing economy" definition. When studying this consumption model, researchers most often use the terms "collaborative economy" and "sharing economy". The collaborative economy is a broader concept and includes interactions between individuals, between legal entities, as well as between individuals and legal entities, while the sharing economy is usually considered when analyzing P2P transactions (between physical persons).

Later, many authors defined the sharing economy as the cooperative economy, implying activities based on digital platforms that form an open market for the temporary use of goods and/or services [30–36].

Important characteristics of the collaborative economy include no change of ownership (which corresponds to the definition by the European Commission, 2016)[1], as well as fast-growing platforms that have entered such sectors as transport and housing, except e-commerce and social media. At the same time, the authors identify four major segments of the collaborative economy: transport, housing, finance and services.

Some studies regard to the sharing economy as to a business model with the following features:

- network model of business organization;
- core competencies are focused on software;
- liquid assets dominate in the property structure;
- the company's strategy is focused on customer experience;

[1] European collaborative economy forum, shared thinking for a collaborative Europe. 2016. URL: http://eucolab.org/wp-content/uploads/2016/09/Industry-viewssurvey_FINAL_SCREEN.pdf (accessed on 16.05.2020).

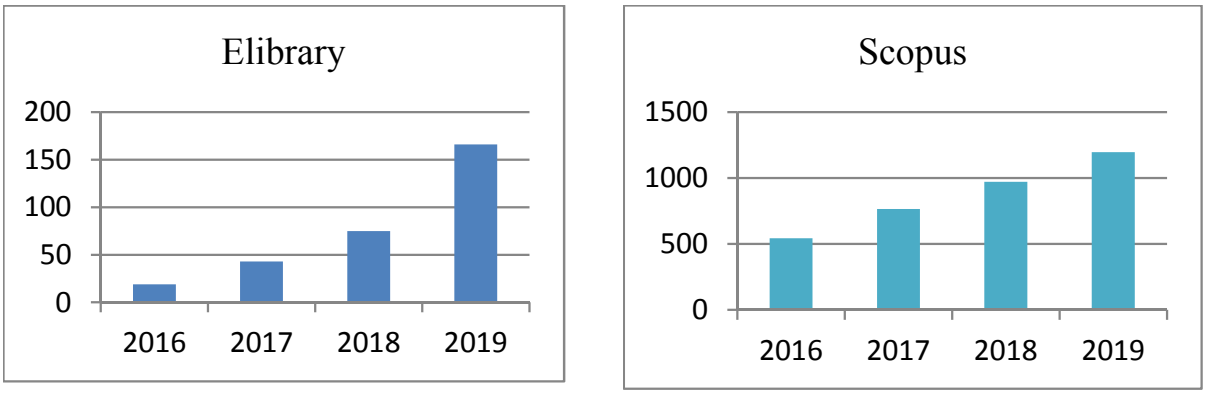

Fig. 1. **Trends in the number of publications on the sharing economy in Elibrary and Scopus**

Source: eLibrary: URL: https://elibrary.ru/query_results.asp (accessed on 10.07.2020); Scopus. URL: https://www.scopus.com (accessed on 10.07.2020).

• the need for labour resources is not fixed, as in traditional business models, but is attracted when needed.

While B 2B, B 2C and B 2G represent the traditional model, the sharing economy is complemented by peer-to-peer (P2P) communications.

Systematizing the main approaches to the definition of the sharing economy allowed to identify common features:

• peer-to-peer communications (P2P) between individuals;

• temporary access to underutilized goods and services, which promotes recycling and increases efficiency in the use of goods and services;

• availability of a digital platform and networking via the Internet;

• exchange of goods and services can be free or for a certain payment.

Some researchers consider the sharing economy as a social process of exchange, implying social ties based on such values as trust, openness, equality, participation, and care [37].

In general, researchers identify various factors in the sharing economy development. For example, Ch. Degryse (2016) identifies three key factors: the Internet, big data analysis and the development of mobile devices and applications. This leads to a completely new labour market and an increased demand for IT specialists. While the current total number of jobs in Russia in mobile technologies is 470 thousand people, by 2022 it will increase to 1.1 million people. According to the RAEC, The average annual growth rates will be about 24%.[2] For example, 1.729 million people are involved in this segment in the United States, and 579 thousand people in Japan. According to the RAEC, in 2019, the demand for highly qualified personnel in IT and communication engineers in other economic sectors (excluding ICT) was more than 150 thousand people, and about 300 thousand people including ICT.

The literature review revealed two key approaches to assessing the impact of investments in the sharing economy on changes in labour relations, the structure of the labour market, and regulation of social relations [38–40].

The followers of the first approach believe that developing the sharing economy in the spheres of transport, real estate, finance, household and professional services will cancel hired labour and will lead to the complete liberalization of services and the expansion of global competition. This will require a revision of basic labour law and

[2] The Sharing Economy. URL: https://raec.ru/upload/files/sharing_economy_facts-figures_rus.pdf (accessed on 15.05.2020).

Table 1

Characteristics of the main conceptual approaches to the sharing economy definition

Concept	Authors	Main characteristics highlighted in research
The concept of the sharing economy	K. Dervojeda et al. [3]; D. Allen, C. Berg [4]; B. Cannon, H. Chung [5]; D. Roos [6]; D. Wosskow [7]; R. Vaughan and J. Hawksworth [8]; L. Hirshon, M. Jones, D. Levin, K. McCarthy, B. Morano [9]; A. Felländer, C. Ingram, R. Teigland [10]; T. Meelen, K. Frenken [11] N. John [12]; Pricewaterhouse Coopers LLP*; P. Grifoni, A. D'Andrea, F. Ferri, T. Guzzo, M.A. Felicioni, C. Pratico, A. Vignoli [13]; G. Kane [14]; P. Goudin [15]; S.-Y. Oei, D. Ring [16]	– Information and communication technology mediation; – increasing consumer awareness; – functioning within web communities; – social commerce/information exchange within these communities; – distributing underutilized assets
The concept of the collaborative economy	M. Felson, J.L. Spaeth [17]; R. Belk [18]; K. Stokes, E. Clarence, L. Anderson, A. Rinne [19]; R. Bostman [20]; J. Hamari, M. Sjöklint, A. Ukkonen [21]; P. Hausemer [22]; J. Owyang, A. Samuel [23]; S. McLean [24]; S.J. Barnes, J. Mattsson [25]; R. Vaughan, R. Daverio [26]	– Peer-to-peer interaction; – mediation of online platforms; – interaction within network communities; – access to goods/services provided by the owner; – monetary/non-monetary compensation; – global and local interaction
The concept of the access-based consumption	F. Bardhi, G. Eckhardt [27]	– Providing temporary access to goods/services; – no transfer of ownership during interaction
The concept of the networking	L. Gansky [28]	– Mediation of information and communication technologies; – real-time interaction; – functioning within web communities; – providing temporary access to goods/services
The concept of the commercial sharing systems	C. Lamberton, R. Rose [29]	– Market regulation; – providing temporary access to goods/services; – no transfer of ownership during interaction

Source: compiled by the authors.

* PricewaterhouseCoopers LLP. The Sharing Economy: Consumer Intelligence Series. The Sharing economy. 2015. URL: https://www.pwc.com/us/en/technology/publications/assets/pwc-consumer-intelligence-series-the-sharing-economy.pdf (accessed on 16.05.2020).

regulation of working hours; as well as the introduction of digital technologies into the human resource management systems of organizations. These processes have been partially used in regulating labour relations. For example, the introduction of electronic work books, legislative consolidation of new forms of remuneration and employment. Investments in developing digital platforms, the base for the sharing economy, will lead to changes in both the service sector and industrial production. For instance, in the service sector, the relationship between the provider and the employer, the algorithm for providing work, calculating labour remuneration, an employment contract, negotiations on wages, employment termination or account deactivation will change; as well as the standards for social security, labour protection, safety, etc.

In the industrial manufacturing sector, the ways of production will change, the interaction between the worker and the (intelligent) machine, and the monitoring and control of the worker will increase.

The followers of a different approach believe that investments in the sharing economy and developing online platforms open up new opportunities in the service sector, where the implemented collaborative projects will focus on the sharing of high-value goods such as cars, housing, etc., on collaborative financing, and not bank loans. They will also provide more opportunities in industry, where more intelligent production will influence the contribution of workers and create a new form of cooperation between people and machines. The main advantage of the new economic model based on the sharing economy is zero marginal cost, which should stimulate economic growth and job creation.

The impact of investments in the sharing economy on the labour market is differentiated and depends on the sector, industry and type of activity.

The labour market is influenced in the following directions:

- changes in the forms of labour organization that become more flexible, take the form of a project, become more open to the ecosystem and much more efficient, especially in terms of innovations;
- arrangements of workplaces, working hours, as well as the subordination between the employer and the employee;
- the impact on the dynamics and structure of the number of self-employed and freelance workers, whose number is steadily growing in the United States, the Netherlands, Germany, France, Russia and other countries with the developed sharing economy.

ANALYSIS OF THE DEVELOPMENT OF THE SHARING ECONOMY IN RUSSIA

A key advantage in the development of the sharing economy as a new business organization model is to benefit from large-scale network effects, access to a global audience, which allows achieving high rates of market share growth. The sharing economy is the result of the simultaneous action of long-term mega-trends, driven mainly by advances in technology, resource scarcity and social change (R. Vaughan, 2015). This model can be used in other areas of the economy, such as energy, telecommunications and retail.

Companies operating in the sharing economy (P2P financing, crowdfunding; online staff, freelancers; coworking; real estate; transport; food sharing; digital content) are startups funded by venture capital. Investments are limited to the costs of building, delivering and maintaining an IT platform, a mobile application and an easy-to-use and secure payment system. The investment is relatively small and represents a manageable fixed cost. To break even, the platform should reach a critical mass of transactions, for which firms typically charge a 1–10% commission of the product

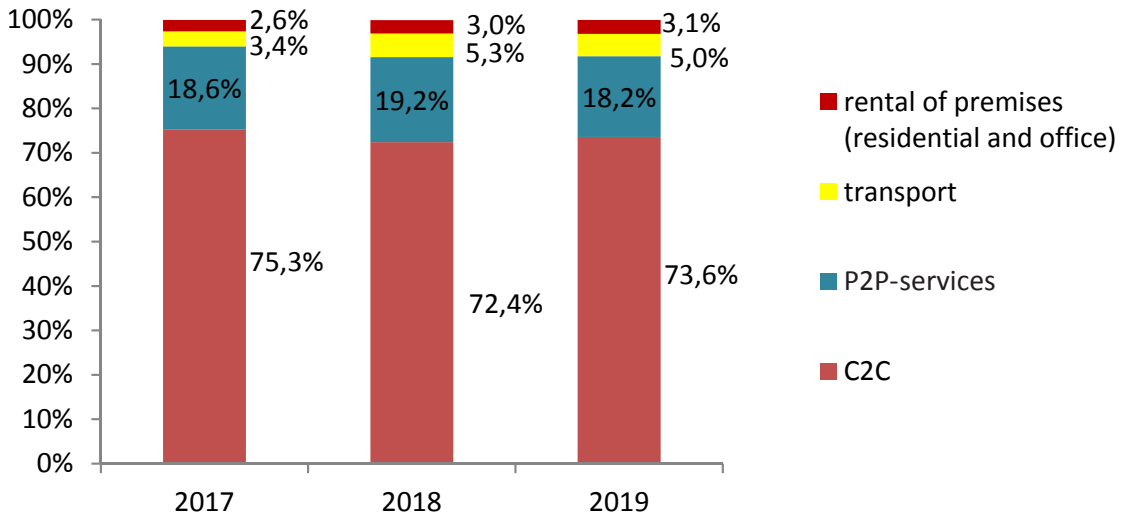

Fig. 2. **Sectoral structure of the sharing economy in Russia in 2017–2019, %**

Source: Sharing Economy in Russia. 2019. URL: https://tiarcenter. com/sharing-report-2019 (accessed on 28.05.2020).

or service value. Once the critical mass is reached, each new user and transaction will increase the margin. Thus, investors should first look at the resilience and potential size of a company's user base, as well as how often users access the platform when analyzing the value of a newcomer to that market.

Using online platforms in various sectors of the sharing economy destroys traditional competition models, since they do not incur the costs associated with the operation and maintenance of assets, their costs are only determined by the cost of transactions, which tends to zero. In particular, players like Airbnb or any other similar platform can achieve higher growth rates than traditional hotel chains, as their development is not constrained by construction and material management.

The Russian Association of Electronic Communications identifies the following sectors of the sharing economy: C2C; P2P services (online freelance exchanges); transport (car sharing, carpooling, means of individual mobility); rental of real estate (residential and office); crowdfunding (co-financing of projects); rental of items.[3] According to the RAEC, the sectoral structure of the sharing economy in Russia is as follows (*Fig. 2*).

Thus, in the sharing economy structure, C 2C has occupied more than 73% over the past three years, followed by P2P services (online freelance exchanges) — about 18%, transport — 5% and rental of real estate (residential and office) — just over 3%.

An important factor for the further development of the sharing economy is the regulatory framework for key sectors: car sharing, crowdfunding, P2P services, renting real estates, coworking, etc. Today, regulatory issues remain unsolved, since legislative regulation does not cover all areas of the sharing economy. The Russian legislation still does not define the concepts of "car sharing", "P2P financing", "online staff", "freelancers", "food sharing". As for the timeshare, the activities of such enterprises are not licensed, and the Federal Tourism Agency does not control their activities. In Russia, the current regulatory legal acts and federal laws of a civil law regulate general legal issues between the parties of the shared property. Currently, many experts note an urgent need for legislative study of issues of labour relations (online freelance exchanges), security (car

[3] Sharing Economy in Russia. 2019. URL: https://tiarcenter. com/sharing-report-2019/ (accessed on 28.05.2020).

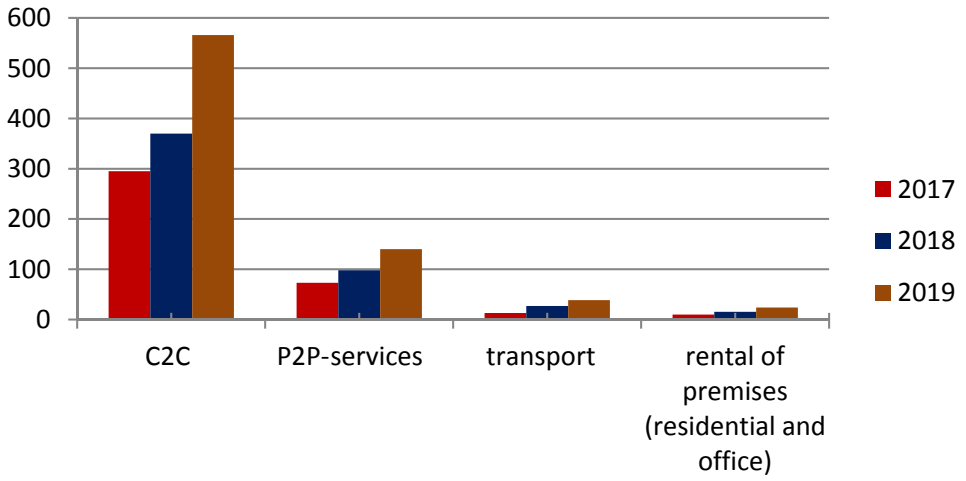

Fig. 3. **Volume of online services transactions by key sectors of the sharing economy in Russia, billion rubles**

Source: Sharing Economy in Russia. 2019. URL: https://tiarcenter.com/sharing-report-2019 (accessed on 28.05.2020).

sharing), and tax administration (real estate) in the sharing economy. Sharing economy industries such as crowdfunding and rental of things make up about 0.1% in total. Many experts note the stagnation in crowdfunding, partly due to the lack of a legal framework for crowdfunding online platforms. However, since January 1, 2020, Russia has a Federal Law regulating the operation of online platforms. The law enshrines such concepts as utilitarian digital rights, investment platform, etc., restricts attraction of investments. The Central Bank of the Russian Federation registers these investment platforms (crowdfunding platforms). Nevertheless, experts rate high the growth potential of these sectors of the sharing economy (*Fig. 4*). According to the World Bank, by the end of 2020, the volume of crowdfunding will increase to $ 90 billion.

Currently, 96.7 million people in Russia are active Internet users, which indicates the further development of the sharing economy industries. Besides, infrastructure support and operation of digital online platforms are an important condition for the development of the current and new sectors of the sharing economy. This leads to certain structural changes in employment in the labour market. The rise of online freelance exchanges, the second largest industry in the sharing economy, opens up opportunities for increasing the share of the self-employed in the economy. In 2019, 2.5 million self-employed worked as freelancers on online platforms. Considering the current rise in unemployment in many traditional sectors of the economy, the development of online freelance exchanges can become an effective tool in solving employment problems.

Table 2 shows the digital platforms where the industries of the sharing economy in Russia are based. Held by the RAEC in 2017, the round table "Sharing Economy in Russia" provided a definition of the shared economy company. The sharing economy is defined as "an online platform that allows people and companies to unite in a community to share or exchange resources they own".[4] In our opinion, it is not correct to equate the concepts of "sharing economy companies" and "online platforms". Indeed, companies operating in this area cannot exist without

[4] The Sharing Economy. URL: https://raec.ru/upload/files/sharing_economy_facts-figures_rus.pdf (accessed on 15.05.2020).

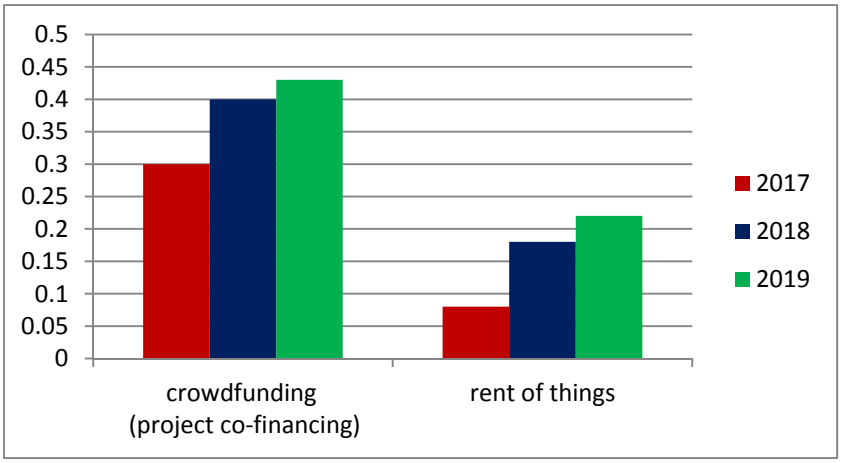

Fig. 4. **Dynamics of the volume of transactions of online services in the industries of crowdfunding and rental of things in Russia, billion rubles**

Source: Sharing economy in Russia. 2019. URL: https://tiarcenter.com/sharing-report-2019/ (accessed on 28.05.2020).

a digital platform, but these concepts are not identical.

Structural shifts in the labour market are accompanied by changes in the educational services market, namely, the growth of educational online projects, 48% of which were created in 2019. By the end of 2019, about 20% of startups in Russia are educational projects. Companies have to attract staff with new competencies in IT, which stimulates the demand for educational services in this area.

First large companies appeared in the sharing economy in 2006–2007. In 2007, about 40 companies in the world attracted $ 43 million in venture capital investments. There was a sharp increase in the number of companies both in Russia and in the world until 2015. In 2010, they more than doubled compared to 2007 and there were about 85 companies. In 2013, the number of companies was about 271. Since 2015, the growth rate of companies in the sharing economy slowed down, and in 2019, the amount of attracted venture investments on average per company decreased to $ 4.8 million (*Table 3*).

The high growth potential of companies in the sharing economy requires a certain institutional structure and improvement of the regulatory framework both at the national and international levels. In 2019, the international non-governmental non-profit economic organization Global Alliance of Sharing Economy (GLASE)[5] was established. The main goal of the company is to unite the business communities of the sharing economy, facilitate the exchange of resources and business opportunities. The revenues of the sharing economy companies will grow according to the forecasts by international analytical and consulting companies such as PWC, BCG, and statista.com, as shown in *Fig. 5*.

According to the forecasts of companies such as PWC[6], BCG and Juniper Research[7], the development prospects for the sharing economy are quite optimistic and demonstrate high growth rates. We think, in the current global economic crisis caused by

[5] URL: https://www.globalase.org/about_7.html (accessed on 28.05.2020).

[6] Sharing or paring? Growth of the sharing economy. URL: https://www.pwc.com/hu/en/kiadvanyok/assets/pdf/sharing-economy-en.pdf (accessed on 18.03.2020).

[7] Sharing economy revenues set to triple, reaching $ 20 billion globally by 2020. URL: https://www.juniperresearch.com/press/press-releases/sharing-economy-revenues-triple-reach-20bn-2020 (accessed on 23.05.2020).

the virus pandemic, considering the IPO results of the largest sharing economy companies achieved in 2019, the growth rates will be lower. In particular, before the IPO, investors estimated Uber at $ 120 billion, but in June 2020, the company's market capitalization was only $ 51.34 billion. Another large sharing economy company in the American market — Lyft lost more than 40% of its capitalization by the end of 2019. Another coworking company, WeWork, failed to go public with the IPO. The financial losses resulted in the companies' plans to reduce the number of employees.

DEVELOPMENT RISKS OF THE SHARING ECONOMY

Currently, the risks associated with the sharing economy are largely due to the lack of elaboration of the mechanism for protecting consumer rights, personal data, as well as the safety of individuals and legal entities using certain digital platform services [41–46]. Each sector of the sharing economy has certain specific risks. Timeshare is one of the most risky segments. Some researchers consider timeshare as a financially risky way to own a resort property reserved for a client at certain times of the year. In other words, timeshare is a shared ownership model of vacation property whereby multiple owners have exclusive use of a property for a period of time according to the timeshare agreement. Timeshare has been developed in countries such as the United States, Spain, Thailand, Israel, etc., however, a lot of countries have faced serious problems with deceived customers and unscrupulous companies. For example, the UK has launched a unique timeshare hotline service (https://timesharehelpline.net/). This is essentially a free service for timeshare owners and consumers provided by KwikChex.[8] The main risks to the development of the sharing economy, including timeshare, are as follows:

1. Unfair companies. KwikChex has estimated that in the UK well in excess of £ 150 million has been lost by consumers to the activities of unscrupulous timeshare companies over the last 5 years.[9]

2. Lack or decrease in trust to digital platform services. Companies like Uber and Airbnb, as well as other services in the sharing economy, cannot exist without the right number of users and funding. Here, an important factor is the trust of citizens, based on ensuring information security and personal data protection.

3. Pricing policy risks. There must be a clear understanding, which part of customers should be subsidized and which should be charged. Due to competition, this factor may lead to the platform shut-down. For example, ride-sharing service Sidecar appeared before Uber or Lyft, but it did not succeed. It was just impossible to create a sufficient base of drivers and passengers, as well as to attract the necessary venture capital.

4. Weak protection of customer personal data.

5. Low security of digital data exchange.

6. Timeshare is not tourist service, thus, does not have special legislative acts and regulatory institutions. In particular, there was non-profit organization "Club Companies Association of Russia". In 2016, this organization was liquidated. In 2018, the Rustime Association was established in Russia to protect the interests and rights of timeshare owners. Due to the great number of deceived customers, timeshare has not been properly developed in Russia.

7. It is almost impossible to sell a timeshare, since there is no secondary market for this type of service.

[8] URL: https://kwikchex.com/aboutus/.

[9] URL: https://rdo.org/news/important-advice-re-increasing-risks-related-to-timeshare-claims-businesses/.

Table 2

Major digital platforms by industry in the Russian sharing economy

C2C	P2P-services (online freelance exchanges)	Transport (car sharing, carpooling, means of individual mobility)	Rental of real estate (residential and office)	Crowdfunding (co-financing of projects)	Rental of items
Avito	Avito	Uber	Avito	Planeta.ru	Next2U.ru
Youla.ru	Youla.ru	Yandex.ru/drive	Airbnb	Boomstarter	RentMania
VK.com	Youdo	Delimobil.ru	Cian.ru	Crowdrepublic	Avito
Odnoklassniki.ru	Profi.ru	Belkacar	Regus	Kickstarter	
Instagram	freelancehunt	Blablacar	Workki		
	fl.ru	VK.com	Sok		
	freelancehunt	Odnoklassniki.ru	Wework		
	freelance.ru	Poehalivmeste	Deworkacy		
	weblancer	Samocat	Coworkstation.ru		
	kwork	Whoosh			
	kadrof	Togo			

Source: compiled by the authors.

Table 3

Global dynamics of the number of companies and the volume of attracted venture capital investments in the sharing economy

Indicator	2007	2010	2013	2016	2019
Number of companies	40	85	271	420	768
Growth rate of the number of companies, %		213	319	155	183
Venture capital investments, USD million	43	130	1740	23400	3700

Source: compiled by the authors based on Listoftop Sharing economy data. URL: https://www.crunchbase.com/hub/sharing-economy-companies#section-people (accessed on 23.05.2020).

8. Property risks associated with possible damage or loss of property value. This is particularly relevant for rental of real estate and timeshare.

9. Financial risks associated with the fact that the development of the sharing economy requires venture capital investments in online platforms. At the same time, it is difficult to reach breakeven. In particular, many car sharing services are still unprofitable. The net loss of Uber reached 8.5 billion dollars by the end of 2019.

9. The legal and regulatory framework for the sharing economy companies requires significant improvement in terms of consolidating the basic concepts (timeshare, car sharing, freelancing, etc.), as well as regulating labour legal relations, taxation and digital security issues. In 2020, the US court recognized Uber and Lyft drivers full employees, and not independent contractors, as before. This incurs additional costs for Uber and Lyft related to benefits, including overtime, guaranteed minimum wages and insurance.

Thus, the development of the sharing economy involves certain risks. Establishing a legal framework for all participants in the cooperative economy can reduce these risks. The sharing economy can be built into the business ecosystem as a whole only in case it is regulated by laws.

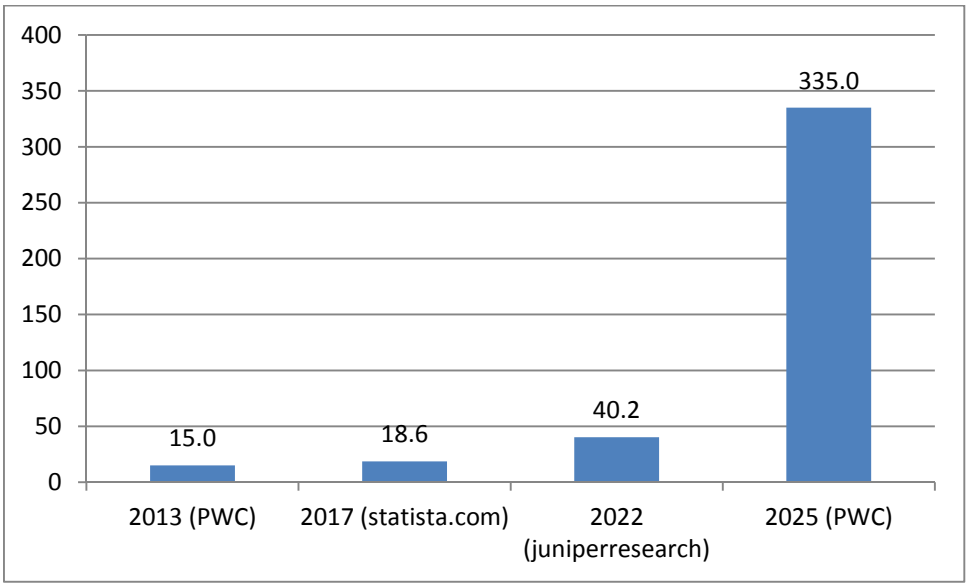

Fig. 5. **Global sharing economy revenue, billion rubles**

Source: Sharing or paring? Growth of the sharing economy. URL: https://www.pwc.com/hu/en/kiadvanyok/assets/pdf/sharing-economy-en.pdf (accessed on 18.03.2020); Revenue of platform providers in the sharing economy worldwide in 2017 and 2022. URL: https://www.statista.com/statistics/878844/global-sharing-economy-revenue-platform-providers (accessed on 23.04.2020); Sharing economy revenues set to triple, reaching $ 20 billion globally by 2020. URL: https://www.juniperresearch.com/press/press-releases/sharing-economy-revenues-triple-reach-20bn-2020 (accessed on 23.05.2020).

ASSESSING THE IMPACT OF INVESTMENTS IN THE SHARING ECONOMY ON THE EMPLOYMENT STRUCTURE

Important qualitative parameters of Russian and foreign labour markets is the employment structure by type of economic activity [47]. We believe that investments in developing the sharing economy sectors will contribute to intensive structural changes in the labour market. We cannot build a correct regression model allowing to assess the employment growth in the field of information and communications under the influence of investments in the sharing economy, since the statistics for the development of the sharing economy sectors in Russia cover only 2017–2019. However, the statistics on investment and employment in the sharing economy sector for foreign countries allowed us to build a regression model to assess the impact of investment in the sharing economy on employment growth in this sector. We carried out all calculations in the Ipython Notebook program in the Python programming language. The graphs were built by means of the Matplotlib.pyplot module, and the regression model used the Scipy, Numpy, SkLearn modules.

The resulting indicator was the employment in the sharing economy sectors, and the free variable was the total venture capital investments attracted by these companies. The model exploited the data from 50 sharing economy companies.[10]

The correlation coefficient for a free variable was determined by the formula

$$r = \frac{\sum_{i=1}^{n}\left(x_n - \bar{x}\right)\left(y_n - \bar{y}\right)}{n\sigma_x\sigma_y},$$

[10] List of top Sharing economy. URL: https://www.crunchbase.com/hub/sharing-economy-companies#section-people (accessed on 23.05.2020).

where n is the number of observations; x is the values taken by variable X; y is the values taken by variable Y; x, y are average values of X and Y; σ is the standard deviation of the corresponding statistically significant factor attribute.

The correlation coefficient for variable X1 (total venture capital investments) was 0.795.

To build a regression model, we find a linear approximation by the least squares method:

B 1 = 7.28,

B 0 = 2522.13.

The general regression model is as follows:

Y = B 0 + B 1*x1 + B 2*x2 + ... Bn*xn.

We get the following regression model:

Y = 7.28* x1 + 2522.13.

The determination coefficient was R^2 = = 0.91.

Fig. 6 shows aligning regression model and data.

The correlation and regression analysis showed that investments in the development of the sharing economy lead to the growth of employees in this sector. The rapid growth of employees in sharing economy companies leads to structural shifts in the labour markets in the countries with investments in this sector, primarily China, the USA, Germany, and France. Currently, 12 global platforms in Europe dominate in many sectors of the economy. According to a study published in 2016, there are about 176 global platforms in the world, most of which are concentrated in Asia and North America (Peter C. Evans, Annabelle Gawer, 2016) [31]. The market capitalization of these public companies exceeds $ 4 trillion. The number of employees in these companies exceeded 1308 million people. The specific impact of digital platforms on employment and labour markets is that their functioning implies employment growth due to the creation of third-party ecosystems, which is proved by a number of studies (*Table 4*).

Since the first companies in Russia are quite recent — Avito (2007), Uber (2009), Youdo (2012), Profi.ru (2014), Youla (2015), Yandex Drive (2018), etc. — the indicators of the sharing economy are not high enough compared to the countries such as China and the United States. At the same time, the development of this sector impacts the labour market, which also experiences employment structural shifts. *Table 5* shows the structure of employment by type of economic activity in the Russian labour market.

We divided all economic activities into five main groups. We combined them according to the methodological approach proposed by A. V. Kashepov [48]. This approach is based on the expert assessment of economic activities divided into "conditionally regressive", "conditionally neutral" and "conditionally progressive". An important supplement of this study is that "conditionally regressive" activities include agriculture and mining (Group I), "conditionally neutral" — utilities and social services, public administration (Group III), and "conditionally progressive" activities include the ones from Groups II, IV and V.

Thus, considering the employment structure in the Russian labour market by type of economic activity, we noted structural changes in all five groups in the period of 2005–2019. Compared to 2005, in 2019, there was a decrease in the share of employees in Group I and Group II in the employment structure in the Russian labour market. The increase in the share of employees was in Groups II, IV and V. Investments in the sharing economy became more active in 2014–2015, although the first company in this sector, Avito, appeared in 2007. In 2019, the number of employees in the field of information and communications increased, as well as in professional, scientific and technical by 146% compared to the base year of 2005. *Table 6* shows the growth rates of the number of employees by groups.

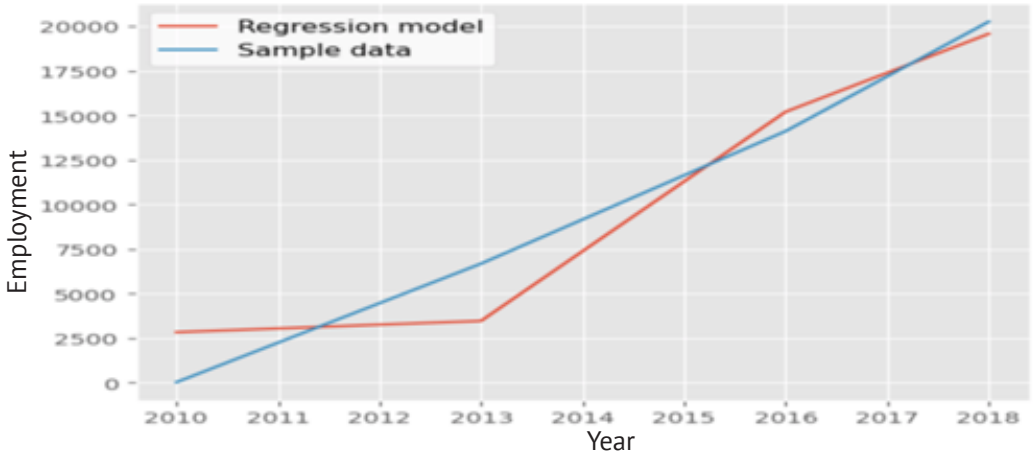

Fig. 6. **Aligning Regression Model and Data**

Source: compiled by the authors.

Table 4

Geographical distribution of economic platforms of publicly traded companies

Region	Number of platforms	Market capitalization, USD billion	Number of employees, million
Asia	82	930	352
North America	64	3123	820
Europe	27	181	109
Africa and Latin America	3	69	27
Total	176	4303	1308

Source: Peter C. Evans, Annabelle Gawer. The Rise of the Platform Enterprise A Global Survey. URL: https://www.thecge.net/app/uploads/2016/01/PDF-WEB-Platform-Survey_01_12.pdf (accessed on 23.05.2020).

Table 5

The structure of employment by type of economic activity in the Russian labor market

Indicator	2005		2009		2013		2019	
	People, thousand	Share, %	People, thousand	Share, %	People, thousand	Share, %	People, thousand	Share, %
Employed — total	66 191	100	69 410	100	71 391	100	71 933	100
Group I (agriculture, mining)	7948	12	7100	10	6532	9	5827	8
Group II (manufacturing, construction)	16 297	25	15 234	22	15 723	22	15 250	21
Group III (utilities and social services, public administration)	19 704	30	22 500	32	22 654	32	23 091	32
IV group (trade, transportation and storage, hotels, catering, finance and insurance, real estate)	18 501	28	20 247	29	21 825	31	22 299	31
Group V (activities in the field of information and communication, as well as professional, scientific, technical)	3740	6	4330	6	4657	7	5467	8

Source: Labour market, employment and wages. URL: https://gks.ru/labour_force (accessed on 28.05.2020).

Table 6

Growth rates of the number of employed in the context of the grouped types of economic activity, compared to the base year 2005, %

Groups of economic activities	2006	2009	2013	2016	2019
Group I (agriculture, mining)	101	89	82	81	73
Group II (manufacturing, construction)	102	93	96	94	94
Group III (utilities and social services, public administration)	104	114	115	119	117
IV group (trade, transportation and storage, hotels, catering, finance and insurance, real estate)	108	109	118	120	121
Group V (activities in the field of information and communication, as well as professional, scientific, technical)	110	116	125	133	146

Source: Labour market, employment and wages. URL: https://gks.ru/labour_force (accessed on 28.05.2020).

The number of employees mostly increased in Group V, and the growth rate increased in 2019. Thus, the need for employees with professional competencies in the field of information and communication, scientific and technical spheres is increasing more intensively.

The sharing economy sectors developing in Russia have a significant impact on the labour market and its structure, because:

1. They contribute to the growth of employees in the IT and high-tech sectors of the economy, as evidenced by employment structural changes by type of economic activity (the share of employees in "conditionally progressive" types of activities is increasing).

2. The development of sectors such as online freelance exchanges and transport contributes to the legalization of the gray labour market. This is traced in the increase of self-employed citizens and the decrease in the number of illegal employees in the taxi market. This is proved by the research that studied the influence of Uber on the socio-economic development of Russia in the cities with a million-plus population: Moscow, St. Petersburg, Kazan, Yekaterinburg and Novosibirsk [49]. Published in 2017, this research estimated the future development of Uber in case of optimistic scenario. The scenario assumes total employment legalization in the market by 2020 and the transition of the illegal workers to the Uber system. Optimistically, due to the development of only one sharing economy company, the number of legal employees in the economy of the cities may reach 23.7 thousand people. [49]. The advantages of sharing economy companies in the transport services segment are: the ability to independently determine the work schedule, the ability to organize self-employment for many categories of the population, including the unemployed, the opportunity to earn.

3. Investments in the sharing economy companies create a demand for highly qualified personnel, since they function on digital online platforms [50]. Looking ahead, investments in the progressive sectors of the sharing economy will require higher levels of education, communication and cognitive abilities, as data collection and processing will be carried out by means of artificial intelligence and machines.

CONCLUSIONS AND RECOMMENDATIONS

In conclusion, we provide recommendations to solve employment problems. The implementation of these recommendations will improve the labour market and increase the investment attractiveness of the most important sectors in the sharing economy.

First, it is necessary to make a system to measure the sharing economy and account for it in official statistics. This will allow assessing the development of the sharing economy sectors and their impact on the quantitative and structural parameters of employment in the Russian labour market.

From the perspective of the state regulation and the impact on the processes in the labour market, it is necessary to provide a regulatory framework for the digital platforms, to form a legislative framework for their activities in the field of labour relations, labour rights, taxation and investment issues.

Another important direction is to guarantee the confidentiality of personal data and safety of citizens participating in the sharing economy.

The above measures and directions for improving state regulation of the sharing economy will accelerate its intensive development and enhance the positive influence on the Russian labour market.

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