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МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

НАУЧНО-ТЕХНИЧЕСКИЕ ВЕДОМОСТИ

САНКТ-ПЕТЕРБУРГСКОГО ГОСУДАРСТВЕННОГО ПОЛИТЕХНИЧЕСКОГО УНИВЕРСИТЕТА

Экономические науки

Том 13, № 2, 2020

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2020

НАУЧНО-ТЕХНИЧЕСКИЕ ВЕДОМОСТИ САНКТ-ПЕТЕРБУРГСКОГО ГОСУДАРСТВЕННОГО ПОЛИТЕХНИЧЕСКОГО УНИВЕРСИТЕТА. ЭКОНОМИЧЕСКИЕ НАУКИ

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ANALYSIS OF THE IMPACT OF ECONOMY DIGITALIZATION ON LABOR PRODUCTIVITY IN RUSSIA

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Digital economy is viewed as a tool to provide competitiveness of the state and high standards of living. The economic basis for improving the welfare of all citizens and the growth of the state's economy as a whole is an increase in labor productivity. At the same time, one of the main factors of labor productivity growth is scientific and technical progress in general, as well as the introduction of digital technologies and computerization of labor in particular. This article is concerned with the research of the key factors of digitalization affecting the level of labor productivity in the regions of the Russian Federation, and assessing their significance. The methodological basis of the research is the econometric model building. Data on labor productivity and digital factors were considered for the regions of the Russian Federation. The control variables used were the number of employees in the regional economy and the share of depreciation of fixed assets, which reflected the impact on productivity of factors such as labor and capital. The development of digitalization in the last decade has led to an expansion of the range of indicators of the digital economy covered by statistical observation. Therefore, the models were built with the use of two sets of numerical indicators: in the period from 2011 to 2017 and from 2006 to 2017. Panel regression models with random and fixed effects were developed. The Hausman specification test showed significant differences in models with random and fixed effects. We revealed a significant positive impact of such factors as computerization of workplaces, use of server equipment, appliance of mobile subscriber devices and the broadband Internet connection to workplaces in organizations which require a high degree of automation. Whether or not the companies had a website or the majority of their PCs had Internet connection posed practically no impact on the level of labor productivity.

Keywords: digital economy, digitalization, labor productivity, digital factors

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АНАЛИЗ ВЛИЯНИЯ ЦИФРОВИЗАЦИИ ЭКОНОМИКИ НА ПРОИЗВОДИТЕЛЬНОСТЬ ТРУДА В РОССИИ

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Цифровая экономика рассматривается как средство повышения конкурентоспособности государства и качества жизни его граждан. Экономической основой повышения благосостояния всех граждан и роста экономики государства в целом выступает возрастание производительности труда работников. При этом одним из основных факторов роста производительности труда выступает научно-технический прогресс в целом, а также внедрение цифровых технологий и компьютеризация труда в частности. Данная статья посвящена выявлению ключевых факторов цифровизации, влияющих на уровень производительности труда в регионах Российской Федерации, и оценке их значимости. Методологической основой исследования выступает эконометрическое моделирование. Рассматривались данные по

регионам Российской Федерации о производительности труда и цифровых факторах. В качестве контрольных переменных использовались численность занятых в экономике региона и доля износа основных производственных фондов, которые влияют на производительность труда и капитала. Развитие процесса цифровизации в последнее десятилетие привело к расширению круга показателей цифровой экономики, охваченных статистическим наблюдением. Поэтому модели были построены с применением двух наборов числовых показателей: за 2011–2017 гг. и за 2006–2017 гг. В данной работе предлагаются модели панельной регрессии со случайными и фиксированными эффектами. Модели панельной регрессии с фиксированными эффектами признаны статистически значимыми и более подходящими к применению с теоретической точки зрения. Тест Хаусмана показал существенные различия в моделях со случайными и с фиксированными эффектами. Выявлено значимое положительное влияние компьютеризации рабочих мест, использования серверного оборудования, применения абонентских устройств мобильной связи и подключения к широкополосному интернету рабочих мест организаций, требующих высокой степени автоматизации. Наличие собственного веб-сайта у организаций и подключение к сети интернет большинства их ПК практически не отражается на уровне производительности труда.

Ключевые слова: цифровая экономика, цифровизация, производительность труда, цифровые факторы

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Introduction

Nowadays the current state and further development of digital economy receives special attention. The digital economy is viewed as a tool to increase competitive qualities of the state and the standards of living [1]. In this study, the term “digital economy” refers to “a state of economic activity characterized by ubiquity and application of digital technologies, which therefore requires availability of the appropriate infrastructure and the Internet. Distribution and application of these elements is ... digitalization of economy, i.e. the process of its formation” [2].

Successful functioning of the digital economy is ensured with the development of infrastructure (access to the Internet, software and telecommunications), e-business (economic activity through computer networks) and e-commerce (distribution of goods via the Internet) [3, 4].

Digitalization of economic sectors and of the whole country is becoming an inescapable fact. There is a gradual introduction of digital platforms for controlling enterprises of engineering business, artificial intelligence technologies in industry, finance, medicine and etc. [5–8].

A vast majority of Russian organizations use personal computers in their activities (Fig. 1). By now, their implementation has been completed almost everywhere. This is also the case of the use of the global information resources and the broadband Internet connection. At the same time, the local area networks and proprietary servers are not applied in all organizations yet.

Impact assessment of digital technologies implementation is carried out in terms of the ratio of results to costs. The criterion for the effectiveness of the digitalization process is the acceleration of economic growth in the regions and the country as a whole [9, 10]. In this case, various indicators can be used as a result indicator. One of them is the level of labor productivity.

The purpose of the study is to identify key factors of the economy digitalization and assessment of their impact on the level of labor productivity in the regions of Russia.

Research methods

The instrumental basis of the research is the method of econometric model. The authors used panel regression models that have an advantage over conventional regression models, since they consider the specifics of development of the particular regions of the country.

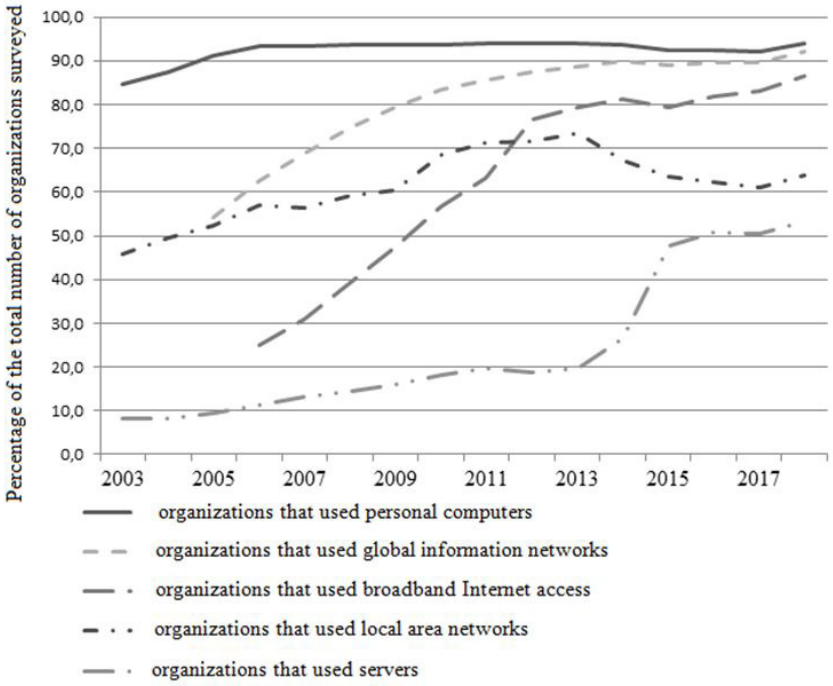

Figure 1. The use of digital technologies in the activities of organizations of the Russian Federation in 2003–2018

Source: Done by the authors based on Rosstat data [11, 12]

In relation to this study, the following models were constructed [13–15]:

1. Panel regression with random effects (PRRE):

$$Y_{i,t} = X_{i,t}\beta + u_i + \varepsilon_{i,t}. \quad (1)$$

2. Panel regression with fixed effects (PRFE):

$$Y_{i,t} = a_i + X_{i,t}\beta + \varepsilon_{i,t}. \quad (2)$$

In the presented models the following notations are used:

$Y_{i,t}$ — values of the effective variable in the i region in the t year;

$X_{i,t}$ — row-vector of values of independent variables in the i region in the t year;

β — column-vector of the model parameters;

$\varepsilon_{i,t}$ — a random component that characterizes the impact of other factors, which are not included into the model on the effective feature in the i region in the t year;

u_i — random effect for the i region;

a_i — fixed effect for the i region.

It is assumed that u_i means manifestations of a random variable that is subject to the normal distribution law, and a_i means constants that characterize the specificity of the i region.

The information base for the analysis is the official statistical data for 77 regions of Russia [11, 12].

The effective indicator is the level of labor productivity, which is represented in the models by the volume of GRP per a person employed in the region's economy at constant prices in 2017. In this study, the logarithmic values of this indicator are used as an endogenous variable, since their distribution within the year follows the normal law (Fig. 2).

Dynamic analysis of the distribution density function shows that since 2003 there has been an increase in labor productivity in the regions. In addition, since 2011, there has been a trend towards regional convergence. The graph represents this trend in the growth of the maximum of the density function. Thus, we can draw a conclusion about the convergence of Russian regions in terms of labor productivity in recent years.

Exogenous variables of models express the influence of both innovative factors of production caused by the process of digitalization, and basic ones [16–18].

The development of digitalization in the last decade has led to an expansion of the range of indicators of the digital economy covered by statistical observation. Therefore, with the use of two sets of numerical indicators certain models were built: in the period from 2011 to 2017 and from 2006 to 2017.

At the first stage of the study, panel regression models were obtained, which were based on the initial data for a relatively short period (from 2011 to 2017). However, from a theoretical point of view, they are of scientific interest, since they contain an extended list of variables that characterize digitalization.

Due to the inevitability of the process of the economy digitalization, it is necessary to expand onwards the list of indicators of the digital economy registered by the state statistics service, both at the national and regional levels. The identification of the most promising areas of development and implementation of digital technologies that save working time is of particular interest.

Currently, Rosstat evaluates the application areas of specialized software by all organizations of the Russian Federation, without specifying their territorial affiliation. In this regard, the retrospective dynamics of these values has no noticeable fluctuations over the years of the study (Fig. 3). While information about specialized software which was designed to support sales, planning the resource potential of the enterprise and other goals, recorded in the context of Russian regions, could reveal additional drivers of labor productivity growth.

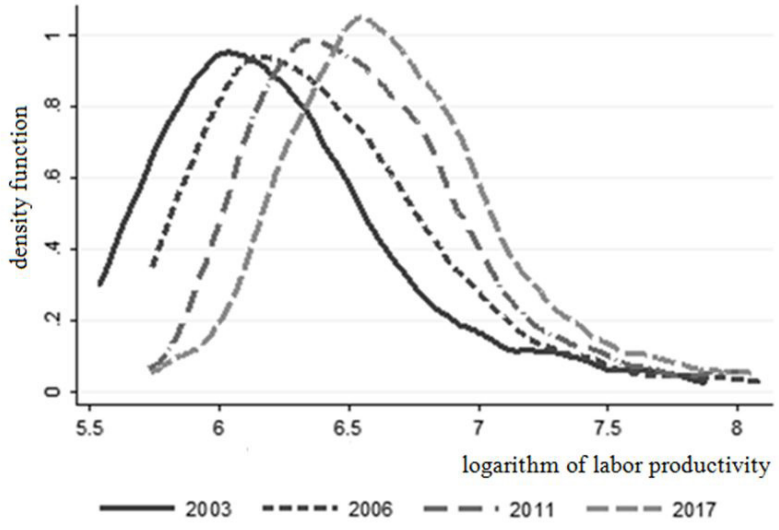

Figure 2. Distribution of Russian regions by labor productivity in 2003, 2006, 2011 and 2017.

Source: Done by the authors based on Rosstat data [11]

The models use the logarithm of a number of people employed in the regional economy and the coefficient of depreciation of fixed assets of enterprises and organizations in the region as control variables. Logarithmic numbers of the employed in the economy characterize the use of labor as a factor of production. The degree of depreciation of fixed assets expresses the influence of the quality of the applied labor resources on the results of production.

Basic variables additionally assume a logical control function over the models. In accordance with the law of decreasing marginal productivity, the growth of the number of employees in the economy of the

region should cause a decrease in productivity, all other things being equal. The amount of depreciation of fixed assets should have the opposite effect on the effective indicator. So, from a theoretical point of view, we should expect negative values of regression coefficients with these control variables.

At the second stage of the study, panel regression models were constructed based on the data for the period from 2006 to 2017.That led to a reduction of a number of factors that characterize the digitalization of the regional economy, since some indicators were not registered by Rosstat until 2011.

The following factors were excluded: share of organizations that used electronic document management systems; share of organizations that used electronic data exchange between their own and external information systems, and the number of active subscribers to the mobile broadband Internet per 1000 people.

On the other hand, the list of control factors was supplemented with an additional variable "crisis". It reflects the impact of the global financial crisis of 2008 with a time lag of 1 year on the economy of Russian regions.

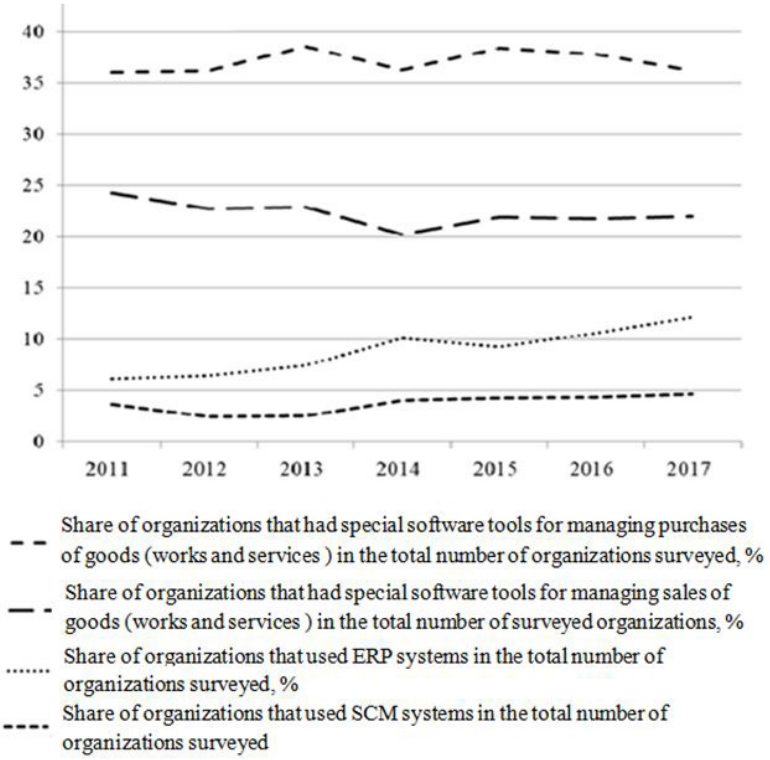

Figure 3. Organizations of the Russian Federation using specialized software in 2011–2017.

Source: Done by the authors based on Rosstat data [11, 12]

Obtained results

All panel regression models obtained at the first and second stages of the study were statistically significant with a high confidence probability. The sample size (77 regions of Russia) slightly differed from the size of the total population. The Hausman specification test showed significant differences in models with random and fixed effects. This indicates a preference for the models with fixed effects over the models with random effects [13, 19, 20]. In addition, panel regression models with fixed effects allowed identifying a greater number of factors (among the studied ones) that have a significant impact on the level of labor productivity in the regions of Russia.

The use of periods with different duration at different stages of the study did not affect the significance of regression coefficients for control variables. This means that traditional factors of production, such as

labor and capital, show the significance of their impact on labor productivity at any level of study (columns 3 and 5 of the table). According to theoretical expectations, the numerical values of the coefficients by the control variables in both models were negative. This means that with 1% growth in the number of employees in the regional economy, we can expect a decrease in labor productivity by 0.74%, all other things being equal. If the state of the fixed assets decays, the level of labor productivity in the region will fall. The coefficient for the control variable "crisis" also assumed the expected negative value (column 5 of the table), which indicates negative reaction of the level of labor productivity to the occurring and/or development of crisis phenomena in the economy of regions.

Checking the dependence of the effective indicator on the factors of digital economy revealed the following pattern: in a short period of time, it is not possible to prove the significant impact of most factors of digitalization on the dynamics of labor productivity in the regions. According to the values presented in column 3 of the table, four digital economy factors out of nine, which were included in the panel regression model with fixed effects, had a significant impact on the effective indicator. At the same time, a high level of significance is characterized by a positive coefficient for only one digitalization factor which is the share of organizations that had broadband Internet access. However, the numerical values of coefficients for other factors of the digital economy that characterize the degree of infrastructure development and e-business (the share of organizations that used servers; the logarithm of the number of connected mobile subscriber devices per 1000 people; the share of organizations that used electronic data exchange, etc.) were either of low or no significance.

Results of econometric modeling of the impact of economy digitalization on the level of labor productivity in the regions of Russia

Variables	Values of coefficients (size of standard deviations) in models based on source data			
	from 2011 to 2017		from 2006 to 2017	
	PRRE	PRFE	PRRE	PRFE
1	2	3	4	5
Constant	6.500*** (0.356)	9.553*** (0.578)	8.241*** (0.218)	10.62*** (0.242)
Control factors				
Logarithm of the number of employees	-0.0230 (0.0383)	-0.510*** (0.0876)	-0.361*** (0.0297)	-0.736*** (0.0355)
Depreciation of fixed assets at the end of the year, %	-0.00106 (0.000738)	-0.00125* (0.000699)	-0.00152** (0.000666)	-0.00249*** (0.000589)
Crisis phenomena in the economy	-	-	-0.0270*** (0.00926)	-0.0354*** (0.00807)
Factors of the digital economy				
Percentage of organizations that used broadband Internet access, %	0.00126*** (0.000413)	0.00134*** (0.000385)	0.00211*** (0.000415)	0.00178*** (0.000364)
Number of personal computers per 100 employees	0.000217 (0.00129)	-0.000253 (0.00120)	0.00125 (0.00141)	0.00340*** (0.00124)
Percentage of organizations that used servers, %	0.000274 (0.00029)	-0,0000481 (0.00028)	0.00151*** (0.000332)	0.00108*** (0.000291)
Logarithm of the number of connected mobile subscriber devices per 1000 people	-0.00999 (0.0419)	0.00525 (0.0398)	0.0659*** (0.0148)	0.0651*** (0.0129)
Number of personal computers with the Internet access per 100 employees	0.00406** (0.00164)	0.00392** (0.00153)	-0.000754 (0.00174)	-0.00158 (0.00152)
Percentage of organizations that had a website, %	0.000188 (0.00064)	0,0000379 (0.00060)	0.0000589 (0.000727)	0.000252 (0.000634)

Logarithm of the number of active mobile broadband Internet subscribers per 1000 people	0.0480*** (0.0167)	0.0327** (0.0159)	-	-
Percentage of organizations that used electronic data exchange between their own and external information systems, %	0.000320 (0.000231)	0.000377* (0.000215)	-	-
Percentage of organizations that used electronic document management systems, %	-0.000663* (0.000402)	-0.000257 (0.000381)	-	-

Note: the factors marked *** are significant at the significance level p<0.01, ** at the significance level p<0.05, * at the significance level p<0.1.

On the one hand, the use of panel data for a long period of time (from 2006 to 2017), led to reduction of the digitalization factors included in the model, and on the other hand, it allowed to prove the significant impact most of them have on the level of labor productivity in the regions of Russia. Thus, four out of six exogenous variables of the digital economy included in the panel regression model with fixed effects, were significant: share of organizations having used broadband Internet access; number of personal computers per 100 employees; share of organizations that used servers; logarithm of the number of connected mobile subscriber devices per 1000 people (column 5 of the table). It is proved that all of the abovementioned factors have direct impact on the effective feature. At the same time, it is noteworthy that the inconsistency of trends in the distribution density functions of these exogenous features and the resulting variable did not affect the decrease in the significance of the regression coefficients for the corresponding factor variables. For example, Fig. 4 shows a noticeable increase in the degree of stratification of Russian regions by the number of organizations that used their own server in the period from 2011 to 2017. While the convergence of the most subjects of the Russian Federation was observed according to the labor productivity level in the same period (Fig. 2). This may be due to the gradual transition to the use of cloud technologies and the lease of computing power from large IT service providers.

Contrary to expectations, the panel regression model with fixed effects demonstrated the opposite insignificant impact on the level of labor productivity of the number of personal computers provided with the Internet access per 100 employees of organizations (column 5 of the table). This may be due to the increasing unproductive use of working time when installing a PC in places where a high degree of automation of work procedures is not required.

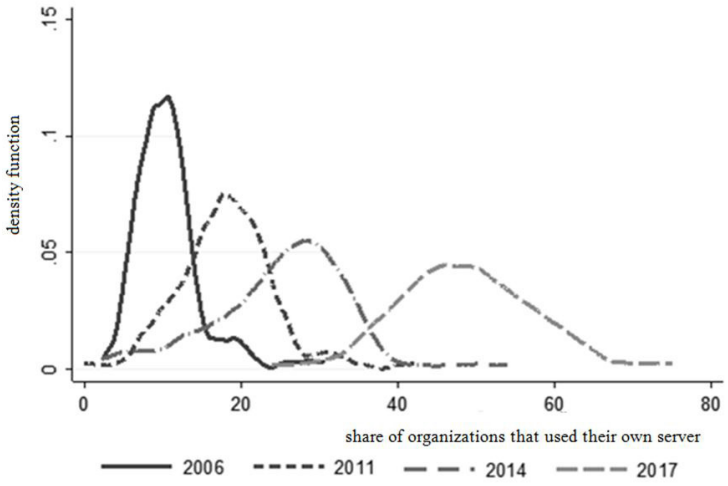

Figure 4. Distribution of regions of the Russian Federation by the share of organizations using their own server in 2003, 2006, 2011 and 2017.

Source: Done by the authors based on Rosstat data [11, 12]

The regression coefficient was also insignificant for such a variable model as the share of organizations that had their own website. To verify the reliability of the obtained result, the study conducted a counter analysis of the dynamics of the density function of the distribution of Russian regions by factor and effective characteristics. Thus, the analysis of the dynamics of the density functions of the distribution of Russian regions by this exogenous factor shows that in 2006 most of the Russian regions were close in this feature and had a small share of organizations that invested in the development of their own websites (Fig. 5).

Over the next five-year period (from 2006 to 2011), Russian regions were "stratified" by this indicator: both regions with a high share of organizations having a website (75% or higher) and regions with a low share of this indicator (less than 20%) began to occur. In 2011 and subsequent years, those regions where the share of organizations with their own web page increased to 30-50% were dominating. The lower limit of the numerical values of the studied feature increased (from 18 to 30%), while the regional stratification became stable. The analysis of the distribution density functions of Russian regions by the level of labor productivity over the same period (Fig. 2) showed a tendency to similarity of regions on this basis. The contradictory dynamics of the density of the distribution of Russian regions by exogenous and endogenous factors was one of the possible reasons for the insignificance of the regression coefficient in the corresponding variable model.

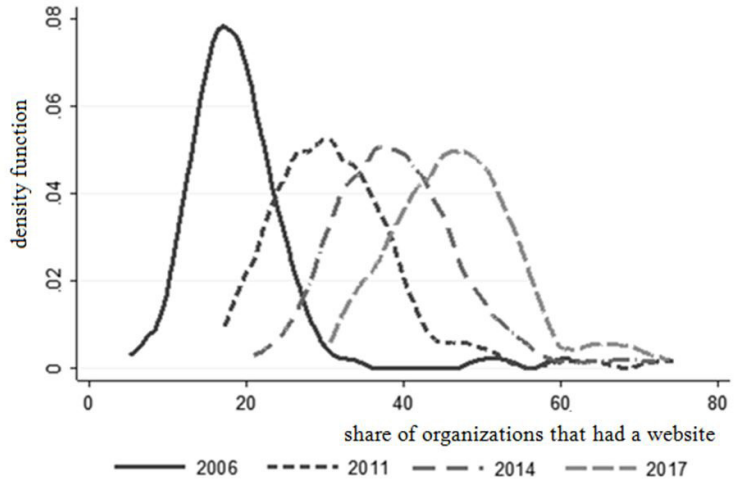

Figure 5. Distribution of regions of the Russian Federation by the share of organizations having a website in 2003, 2006, 2011 and 2017.
Source: Done by the authors based on Rosstat data from [11, 12]

Additional reasons could be the following:

– For many regional companies in Russia, the website is only a mean of publishing business information, and not an effective tool for interacting with customers and increasing sales.

– The companies update information on the websites rarely, which reduces the users' trust to the content and the organization as a whole.

– Organizations allocate insufficient financial resources to promote their websites, etc.

Together, these reasons do not lead to the expected growth in sales and production volumes and, consequently, the level of labor productivity. And in some cases (for example, when placing false information on the website), they entail financial sanctions, which may ultimately affect the growth of production volumes in a negative way.

Conclusion

As a result of the research, the authors found out that the basic factors of production (labor and capital) have significant impact on the growth of labor productivity. This effect is detected at any modeling horizon.

Along with the basic factors and factors of the macroeconomic environment, the level of labor productivity in the regions of modern Russia is also affected by the factors of the digital economy. However, their significant impact can only be tracked when using baseline data for a long retrospective period.

The computerization of workplaces (with controlled access to the Internet), use of server equipment and mobile subscriber devices, and connection of workplaces that require a high degree of automation to the broadband Internet have a significant positive impact on the growth of labor productivity in Russian regions. However, providing access to the Internet for the most PCs of an organization affects the level of labor productivity negatively, which can be explained by the increase in unproductive use of working hours. Whether the companies possessed a website or not had little impact on productivity, which indicates that organizations use other ways to interact with suppliers and consumers.

Directions for further research

This paper considers only some aspects of the impact of digitalization of the economy on labor productivity in the regions of the Russian Federation. We see prospects for further research in the study of the impact of the use of specialized software designed to support sales, planning the resource potential of the enterprise and other goals on the dynamics of labor productivity. In addition, the analysis of the impact of factors on labor productivity on the materials of a large number of specific enterprises in the regions of Russia can reveal the most effective factors of digitalization.

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ANALYSIS OF DIRECTIONS DIGITAL TECHNOLOGIES ARE INTRODUCED INTO INDUSTRIAL COMPLEX

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In the last decade, advanced digital technologies have been actively introduced into the industrial complex leading to increased efficiency of enterprises through changes in their internal business processes, as well as modernization of all production facilities. Further active adoption of digital technologies and their practical application in national industrial companies will open even greater opportunities and economic benefits. As a result, the use of digital technologies in complex solutions will change the business environment, as well as increase competition for all industry enterprises. According to most experts, the scale of this transformation requires a systemic targeted vision of digitalization at the industry level. In the new conditions of development and digital transformation of the industrial complex, enterprises must face new challenges, develop internal business processes, focusing on new factors affecting the functioning and improvement of production. At this stage, this is possible thanks to the use of digital technologies, as well as the active development of new products of the industrial sector of the economy, which have completely new functions. This process will be possible in case of involvement of all participants of industrial transformation and digitization of all production processes. The transition to the digital platform of the industrial complex implies the transition of vertical and horizontal relationships between producer companies and customers, contractors, transport companies to digital format. Thus, a single digital industrial space will create a monitoring tool for the industrial complex of the Russian Federation, which will allow to react and make management decisions quickly. A digital space of this type will help national enterprises to become faster, more flexible and more competitive in both domestic and international markets. This study describes the modern technological way of digital economy. The authors analyzed digital transformation of domestic industrial enterprises in modern conditions and identified the main directions of introduction of digital technologies into the industrial complex.

Keywords: igitalization, industrial complex, industrial economy, industry 4.0, digital economy

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АНАЛИЗ НАПРАВЛЕНИЙ ВНЕДРЕНИЯ ЦИФРОВЫХ ТЕХНОЛОГИЙ В ПРОМЫШЛЕННЫЙ КОМПЛЕКС

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В последнее десятилетие происходит активное внедрение передовых цифровых технологий в отрасли промышленного комплекса, что ведет за собой повышение эффективности деятельности предприятий посредством изменений их внутренних бизнес-процессов, а также модернизации всех производственных мощностей. Дальнейшее активное освоение цифровых технологий и их практическое применение в деятельности отраслевых национальных компаний откроет еще большие возможности и экономические выгоды. Как следствие, использование

цифровых технологий в комплексных решениях приведет к изменению бизнес-среды, а также к повышению конкуренции для всех отраслевых предприятий. По мнению большинства специалистов, масштаб данной трансформации требует системного целевого видения цифровизации на уровне отрасли. В новых условиях развития и цифровой трансформации промышленного комплекса предприятия вынуждены отвечать новым вызовам, развивать внутренние бизнес-процессы, ориентируясь на новые факторы, влияющие на функционирование и совершенствование производства. На данном этапе это возможно благодаря применению цифровых технологий, а также активной разработке новых продуктов промышленного сектора экономики, обладающих абсолютно новыми функциями. Данный процесс будет возможен в случае вовлечения всех участников промышленной трансформации и оцифровывания всех производственных процессов. Переход на цифровую платформу промышленного комплекса подразумевает переход вертикальных и горизонтальных связей компаний-производителей с заказчиками, подрядчиками, транспортными компаниями в цифровой формат. Таким образом, единое цифровое промышленное пространство создаст инструмент мониторинга за промышленным комплексом РФ, что даст возможность быстро реагировать и принимать управленческие решения. Цифровое пространство такого типа позволит стать национальным предприятиям более быстрыми, гибкими и конкурентоспособными как на отечественном, так и международном рынках. В настоящем исследовании дана характеристика современного технологического уклада цифровой экономики. Проведен анализ цифровой трансформации отечественных промышленных предприятий в современных условиях. Выявлены основные направления внедрения цифровых технологий в промышленный комплекс.

Ключевые слова: цифровизация, промышленный комплекс, экономика промышленности, индустрия 4.0, цифровая экономика

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Introduction

Regarding digitalization, attention should be paid not to the ev is characterized by parameters significantly different from the economy of the previous, industrial, technological paradigmolution of the term, but to the phenomenon it describes. For several decades it was nd later artificial resources at the disposal of a person into useful types of them, capable of meeting the person's needs, as well as the nature of relations of people in the process of their joint production activity. Leading Russian and foreign scientists and researchers devote a significant amount of research, both theoretical and applied, to this process.

The information technological paradigm (IT paradigm):

- the needs of people are not only physiological, but also mainly social, there is freedom of business aa process such as "informatization", which was actively developed in the informational and technological paradigm[1] of the economy. The type of technological paradigm of economy means the technological process of transformation of natural and personal activity;
- global networking, virtual specialization and cooperation determine the nature of economic relations between economic entities;
- the main types of economic resources used are information and intellectual ones;
- the dominant factors of production are intellectual labor and capital, knowledge, and information;
- the magnitude of the division of labor is global.

With the emergence and development of the global Internet and modern information and communication technologies, time and place have ceased to be barriers to doing business anywhere in the world. Information and knowledge have become more mobile than capital and people, allowing the world to learn about the properties of any commodity and influence its demand and supply. The period of active formation of a new technological paradigm characteristic of the information economy (knowledge economy) coincided with the world economic crisis of the beginning of the twenty-first century challenging not only to the

[1] https://en.wikipedia.org/wiki/Technological_paradigm

economies of individual countries, but also to their enterprises. The term "knowledge economy" was first introduced by F. Mahlup, referring to the type of economy in which knowledge production is the source of its growth. Subsequently, "post-capitalist" society", "innovative economy", "information society", "high-tech civilization" became synonymous concepts of "knowledge economics".

At the same time, many developed countries of the world are intensively shaping the new technological paradigm of the digital economy through the development of knowledge-intensive technologies and production, in which information, communication and digital technologies become the main resources for the production of goods and services and at the same time new factors of production. The key difference between digitalization and informatization is that the category of informatization is broader than digitalization, covering information processes of diverse kinds, not just digitized ones.

Thus, digitalization is a modern stage of informatization development, which is characterized by the predominant use of digital technologies of processing, transmission, storage and visualization of information, which is due to the emergence, distribution and increase of economic and physical accessibility of innovative technological and software solutions.

According to foreign authors, digitalization of industrial enterprises within the framework of the fourth industrial revolution will lead to complete automation of most production processes, and, as a result, to an increase in productivity, economic growth and competitiveness of leading countries [14, 17]. Many Russian researchers highlight the special relevance of digital transformation of the national industrial complex, justifying this by the fact that this integrated structure, which is a lot of industrial enterprises, is indeed the environment in which communications between all participants, as well as the provision of production and logistics processes, should be as effective as possible [2, 3, 9].

Research objective

Based on the above, the purpose of the study is to determine the peculiarities and main directions of the introduction of digital technologies into the industrial complex in modern conditions. By industrial complex authors mean such a mutually agreed combination of enterprises in industrial point, at which certain economic effect is achieved due to a convenient selection of enterprises in accordance with natural, economic conditions of the region, with its transport and economic-geographical position.

The objectives of the objective are:

- characterize the modern technological paradigm of the digital economy;
- analyze the transformation of the industrial complex of the Russian Federation in modern conditions;
- identify the main directions of digital technologies introduction to the industrial complex of the Russian Federation.

Research methods

The authors used analysis of domestic and foreign sources on the investigated issues, identification of specific features of the concept.

The active introduction of digital technologies into internal and external business processes of enterprises leads to the emergence of innovative business models that ensure the future competitiveness of any industry. The national industrial sector prioritizes the victory in the global technological race, as well as the formulation of a new reference point for digitalization, which will ensure the connection of the financial and intellectual potential of our country [1].

However, there are different opinions regarding the way the digital transformation of the industrial complex and the sphere of business is carried out. The first strategy, digital transformation of "small things", involves selective optimization of business processes using innovative IT technologies. This concept is based on a flexible approach to modernizing production processes. In order to implement this strategy effectively, production must:

- provide automation of processes with counterparties;

• use cloud services to provide universal access to files and applications from any device connected remotely to the system;

• implement Big Data collection and analytics system;

• engage modernization and optimization of internal organizational structure and business processes.

In order to effectively implement this strategy, Russian managers rely on the analytics of a large amount of data to obtain great results in the shortest possible time. This strategy requires effective use of innovative IT technologies to process, analyze, and store large amounts of data. In addition, this functionality requires information technology professionals to determine where and how the data can be used to maximize benefits in the future.

The German Academy of Sciences and Engineering (acatech) has developed a step-by-step guide on digital transformation of production Industry 4.0. According to this manual, in order to create a "smart industry", it is necessary to implement a process of coordination between physical and computing resources. Accordingly, the second strategy is a step-by-step approach to digital transformation that includes six steps, namely [15]:

1. Regulation of the digital environment, which means establishment of a system of legal regulation of the digital economy based on a flexible approach to each sphere, as well as an introduction of civil turnover on the basis of digital technologies.

2. Information infrastructure, which means creation of a globally competitive infrastructure for the transfer, processing and storage of data, mainly based on domestic developments.

3. Personnel for the digital economy, which presupposes providing training of highly qualified personnel for the digital economy.

4. Information security, which includes ensuring information security on the basis of domestic developments in data transfer, processing and storage, guaranteeing protection of interests of individuals, business and the state.

5. Digital technologies, meaning introduction of "end-to-end" digital technologies mainly based on domestic developments.

6. Digital public administration, meaning introduction of digital technologies and platform solutions in the spheres of public administration and provision of public services, including those for the benefit of the population, small and medium-sized enterprises, including individual entrepreneurs.

For successful development in a digital transformation environment, industrial-scale manufacturers need to have a suitable management strategy and a set of competencies. Thanks to these components, the organization will be able to perceive internal and external changes in its business processes with more flexibility and successfully create innovative business models and products [3]. This way industrial companies will maintain their organizational agility regardless of the scale of production, they will be able to balance the experience gained and gained, the creation and modification of new management strategies. Modern digital technologies enable international corporations to transform their internal business processes as soon as possible, modernize their production facilities, and thereby achieve the most effective results from their activities. The introduction of the latest digital and intelligent technological solutions is one of the key global trends in the development of the national industrial complex at the present stage.

Unified digital industrial space of the Russian Federation

In order to improve the competitiveness of the key sectors of the industrial complex of the Russian Federation, it was necessary to create and use national initiatives. In this regard, 2017 became a landmark year for the development of the industrial complex thanks to the active formation and implementation of a new political direction, namely the transition to the "digital economy". The existing technological structure of the economy has reached the limit of its efficiency and in the future will lose high competitiveness compared to the decisions of the digital economy. The conceptual apparatus of the digital economy is multifaceted and diverse, which is a problem, on the one hand, due to the emergence of different points

of view [4]. However, on the other hand, the resulting phenomenon may be the only solution to the fundamental change of the internal architecture of the economic system and modification of the industrial complex of the Russian Federation.

In order to develop industry, in July 2017, "Digital Economy of the Russian Federation" program was adopted, which defined the main stages of development of the economy of the Russian Federation in conditions of digitalization until 2024 [11]. The program was needed, firstly, to integrate the global process of digitalization into the national economic system, and, secondly, to accelerate this process in an orderly manner. Implementation of this initiative implies approval of the operational plan by the Government of the Russian Federation within every three years with regular updating of the list of activities specified in the program.

The Digital Economy Program emphasizes that digital information is a key factor in production and a resource base in the digital economy. Its analysis will provide the most effective decision-making in all spheres of the national economy. The digital economy will allow to form an innovative information space considering the needs of consumers in obtaining reliable and qualitative information, creation and development of national ICT, formation of an innovative technological basis for economic and social structures of the Russian Federation.

The described model of the digital economy in the initiative program consists of the three interacting components, namely:

- markets and industries of the Russian Federation;
- technology platforms and ICT;
- external environment, contributing to the creation of innovative digital platforms and technologies, and effective interaction of subjects of markets and industries of the Russian Federation.

In addition, the Digital Economy of the Russian Federation program provides for the development of several priority areas that will be in the front line of development in the next few years:

- smart city;
- public administration;
- health care;
- standard regulation;
- digital infrastructure;
- technological reserves;
- education and personnel;
- information security.

The Ministry of Energy of the Russian Federation has formed a departmental project "Digital Energy". Taking into account the priorities identified by the President of the Russian Federation, which were approved in the national program "Digital Economy of the Russian Federation" in 2017, the Digital Energy project planned to create a new targeted approach to the vision of the conceptual apparatus «digitalization of the industrial complex» and its active introduction into Russian industrial production in order to create a new national technological base for its further development and to form proposals to increase the competitiveness of the energy industry.

Analysis of Russian experience of transformation of industrial complex in conditions of digitalization

Currently, the Russian Federation is actively working on the introduction of digital technologies in all leading sectors of the economy, special attention is paid to the so-called digitalization of the industrial complex of the Russian Federation. For example, one of the largest producers of aluminum and alumina, RUSAL, introduces innovative information technologies into its production, covering all stages of the production process. In conditions of intense competition, digital technologies become the most important advantage in the Russian market and allow companies to maintain a leading position in their industry, while moving to a qualitatively new level of development.

For RUSAL, the digital transformation is as follows. First, innovative technologies are used, which allow to perform measurements of different types with the help of special probes and sensors, which track, for

example, different technical parameters of a specific production process. The data transfer technologies, corporate information systems, as well as production control systems, the so-called MES systems are both wired and wireless.

As a part of RUSAL's digital transformation of production processes, the entire range of operational information related to technological, production and other processes will be available online at all levels of business process management. In addition, the real-time mode allows for feedback when making any management decision immediately. Digital technologies are used not only in the production processes of the company, but also in the work with clients. A client can place his order in a special app and monitor all stages of its execution in real time.

Thus, it can be said that the conditional strategy of the end-to-end digitalization of RUSAL company includes three directions, namely:

- improvement and full-scale deployment of technical probes, sensors and the equipment operating them in production;
- implementation of MES-systems in production;
- implementation and improvement of corporate systems [7].

In 2018, RUSAL already had a corporate accounting system, or ERP-system, but now the issue of further development was acute. Thus, the management of the company proposed the launch of a mobile app for clients, as well as a supply chain management system that would allow to track the order at each stage of its implementation.

In addition, together with Yandex Data Factory RUSAL launched several projects focused on machine learning and artificial intelligence at some enterprises of the Aluminum Division [13]. AI technologies will be effective when processing large amounts of data, which in turn leads to the identification of certain patterns. In the future, RUSAL intends to bring all technological, repair, commercial, logistics, economic, marketing and other production processes into a single system possible to manage from anywhere in the world. It will become a reality when RUSAL ensures uniformity of all the data of plants, which can be processed, compared and received online.

Such a large-scale campaign of digital transformation requires investment of tens, if not hundreds of millions of dollars. Even with the decline in computer prices, this process is clearly not cheap, as it involves an innovative restructuring of the architecture and hierarchy of the system, as well as the introduction of the latest software and MES systems. Each stage of end-to-end digitalization entails new investments. Each conditional technical sensor installed requires a device transmitting information from it, and consequently another device to receive these data arrays. In addition to powerful stations and data stores, tens and hundreds of thousands of mobile devices, various interfaces, mobile applications, etc., are needed. All this requires certain financial investments, which, if collected, represent substantial amounts.

However, if the company does not digitally transform production, its competitors will do so, thus reducing the cost of their products by several percent. The company itself will not be competitive and will lose its leading position in the market. Therefore, from the point of view of business, these financial costs will be justified, the economic effect of investments in digital transformation of production will pay off quite quickly due to improvement of technological processes, reduction of delivery time of products, improvement of client services, etc.

With the further rapid development of IT technologies, the issue of human participation in all stages of production is acute. For the next 10-15 years, RUSAL intends to adhere to the strategy, in which an AI system will act as an advisor, but the personnel will make the final management decisions. The components which need human interaction in the company internal processes are work with the clients, suppliers, employees, development of human capital. Despite the introduction of digital technologies in all these areas to improve the quality of service and facilitate access to information, as well as reduce the time spent on routine operations, strategic management of production and the company requires human intervention.

The digital transformation of production raises the following question: will there be a need for new specialists? After all, in the future many employees will need additional skills, knowledge of data processing, programming, IT technologies. For example, Yandex Data Factory, with which RUSAL cooperates, employs representatives of a new specialty Data Scientist. These are specialists in the field of building neural network algorithms, which also have an idea of machine learning, etc. Of course, over time and with the development of digital technologies new professions will appear, but not all specialists will have to master the field of artificial intelligence or programming directly.

Traditional specialties will undoubtedly change over time because digital technologies will focus specialists more on causal relationships in production processes. Competence centers will appear, where specialists will remotely monitor all stages of production and remotely regulate the deviations.

Digitalization of industrial enterprises has become an extremely relevant topic in the last few years for several reasons. First, this was due to changes in the competitive environment, in particular, many aluminum manufacturers and other industries are increasingly "going digital". And if earlier digital transformation concerned mainly the sphere of telecommunications, banking, information technologies, now this process affects industrial production [6]. In this sphere there are several simultaneous processes. Thanks to the increased competition and fast development of technologies there is a reduction in cost of the equipment which digitizes production (probes, sensors processing information). In addition, fast development of interesting innovative solutions makes digitalization even more relevant. AI or machine learning technologies allow to achieve such a level of production optimization, which even the most qualified employees are unable to demonstrate simply because their capabilities to process and analyze large amounts of data are not commensurate with AI. Finally, the emergence of innovative and captivating software solutions make digitalization not only a cost-effective, but also an attractive and promising direction.

Features of cyberphysical project "4.0 RU"

The concept of a single digital industrial space in its current form appeared on the margins of the Hannover Messe International Industrial Fair in Hanover in April 2017 [9]. A Russian delegation headed by the Minister of Industry and Trade Denis Manturov visited the German exhibition. The Minister drew attention to an innovative product from Siemens called MindSphere. It's a cloud operating system for the Internet of Things. According to the information on the Siemens website, the cloud operating system MindSphere allows you to connect computers and production equipment to a single digital space. The developers of the revolutionary product argue that the application of this system in production will allow to reduce costs and expenses as much as possible by automatically calculating all economic and logistics processes. In addition, by processing and analyzing a huge amount of data, the MindSphere product allows users to improve the quality of their products to a completely new level.

However, data security issues within the system have not been properly addressed. In this regard, the Russian delegation was invited to further cooperate and sign a partnership agreement on the creation of a national cyberphysical system "4.0 RU" with Kaspersky Lab, not only Russian, but also the world leader in the field of information technologies, which pays special attention to cybersecurity issues in the industrial manufacturing. STAN company management was also present at the Hannover Messe International Industrial Fair. Stan made a strategic decision to join the 4.0 RU project, in which they could offer their own equipment for rolling out the digital platform in practice [10].

A little later, a logistics company Intelma joined the initiative group to create a single digital industrial space of the Russian Federation, which, thanks to the accumulated experience and professional competences of its specialists, takes a leading position in the field of logistics issues. Thus, a working group was formed, responsible for the creation of a single digital space of industry in the Russian Federation, which included recognized high-tech national companies, leaders in the field of production, electronics and information security, namely STAN, Kaspersky Lab, NPP Itelma.

In July 2017, at the exhibition «Innoprom-2017», a prototype of digital production was presented to the President of the Russian Federation, Putin V.V. He launched the production of a fastening element at a STAN machine STT 50-60 in the virtual assembly shop MC-21 of the Irkutsk Aviation Plant. The demonstration model of the cyberphysical project 4.0 RU described a complete production cycle, including all stages: from the company's request to manufacture a specific part to the delivery of the manufactured part by the carrier. The digital approach to the MC-21 starts with the most basic part of the aircraft, namely with a bolt. With the help of animation technologies, the bolt is separated from the engine design and transformed into a schematic image on the screen of the cyberphysical system «4.0 RU».

During the digital part of the design phase, the relative cost indicator is also displayed, which changes when the part parameters change. Note that if you enter an incorrect product parameter, a non-compliance warning appears. At the modeling stage, tools and equipment are selected, and virtual processing of the product takes place in online dialogue mode with the system. Based on the received information about the part and the technology of its manufacture, scanning of databases of enterprises of the Russian Federation for the performance of production of the product is started. By analogy, a selection is made among the logistics partners to deliver the manufactured part to the customer. After pressing START button on the system control panel 4.0. RU starts the process of transition from virtual production to real production, a window with on-line video translation appears to monitor the process of production. When the part is finished, the shipping route of the order by the carrier is displayed on the map. The map shows all the plants that have the necessary capacity to manufacture the part, as well as its cost.

This is what the digital manufacturing process looks like. If these technologies are used by all industrial enterprises of the Russian Federation, all conditions will be created for the creation of a kind of industrial on-line exchange, which will take a certain time. For the effective operation of this system, it is necessary to create a certain infrastructure, the development and construction of which is actively carried out now by the Ministry of Industry and Trade.

Research result

The authors:

• characterized the development of the modern technological way of digital economy in modern conditions;

• analyzed transformation of the industrial complex of the Russian Federation in conditions of digitalization;

• identified the main directions of implementation of digital technologies in Russian industrial enterprises.

Summarizing the above, we would like to note the advantages that the project 4.0 RU will give to the industrial complex of the Russian Federation with effective development. The 4.0 RU cyberphysical system makes it possible to determine the final cost of knowledge-intensive equipment at the design stage by detecting the price of each part of the product [5]. Due to the fact that the design is performed in digital format, it allows to make changes to parameters of parts at each stage, from the design to post-sales service, in online mode, preventing design errors, and as a result, to monitor the change of final cost of the product on the screen.

After that, all enterprises connected to 4.0 RU transmit information to the system about their production capacity, technical characteristics and load. Thus, the customer will be able to determine which enterprise meets the requirements, namely, how long it takes to manufacture the part, the most suitable production facilities in terms of financial optimization, the logistics route of delivery of the finished product to the customer [8]. In addition, the 4.0 RU cyberphysical system will make it possible to reduce the cost of products by increasing the performance of production capacities. This will form the so-called national "producer exchange". The project 4.0 RU on digital transformation of industry of the Russian Federation implies creation of a reliability rating of manufacturers, which will be created based on orders already completed within 4.0 RU.

At the same time, enterprises will be able to offer cooperation to the customer, which will be based on analysis of profitability of production, while focusing on their own priorities and loading production facilities rationally. Thus, the more enterprises are included in the 4.0 RU system, the more efficient its operation will be.

Summary

To summarize the above, it is impossible not to note several advantages that digital technologies give to the industrial complex of the Russian Federation, namely:

- Increased flexibility of production due to dynamic change of technical characteristics of production process. This agility in business process management creates a new competitive advantage and can potentially lead to higher profits.
- Information is integrated of all stages of the product production life cycle, which allows to optimally and comprehensively address the problems of efficient production process, as well as quality of produced products, environmental safety, creation of new business models, etc.

However, on the other hand, the level of dependence of the enterprise on the applied digital technologies in production processes is increasing. As production engages a higher degree of robotics and automation, employees of enterprises are increasingly excluded from making corrective and management decisions, and there are less possibilities of immediate influence on production processes. However, most experts are convinced that soon digitalization of the industrial complex will lead to increased productivity, improvement of product quality, reduction of product cost, increase of effective use of investments and rapid introduction of new products to markets. As a result, we will get increased productivity indicators, improved quality of parts design and production, reduced cost of products, control over effective use of investments, high speed of production of new products.

It is necessary to strive for digital transformation of the whole industrial complex to achieve maximum efficiency. But this process is possible only when the participants of industrial transformation digitize all their production processes. The transition to the process of digitalization of the industrial complex implies the transition of vertical and horizontal relationships between producer companies and customers, contractors, transport companies to digital format.

Thus, a single digital industrial space will create a monitoring tool for the industrial complex of the Russian Federation, as well as for rapid response and management decisions. Such digital space will allow national enterprises to become faster, more flexible and competitive both in the domestic and international markets. Due to the technical and organizational complexity of the formation of such digital platforms, the high risks of their development and successful implementation, the state should play an important role in digitalization of the industrial complex. The importance of state regulation and support of new digital technologies is confirmed by both domestic and foreign experience. In this regard, measures to digitalize the industrial complex should be incorporated into State industrial policy. This will allow to solve problems relevant to the digital economy to accelerate industrial growth, create import-substituting industries, increase labor productivity in industry, etc.

Directions for further research

In the end, the development and introduction of digital technologies has given impetus and continues to stimulate the production of the industrial sector. They help to solve not only important issues of competition and efficient production, but also problems of increasing the efficiency of Russian industrial enterprises and reducing the cost of final products, as nowadays manufacturers are forced to adjust, modify and develop quickly and flexibly. Experience of development and introduction of digital technologies in production processes of industrial enterprises, creation of a single digital industrial space creates prerequisites for creation of new management strategies in modern conditions, as well as a completely new model of industrial production in conditions of digital transformation.

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THE ROLE OF PUBLIC PROCUREMENT IN THE DIGITALIZATION OF THE ECONOMY AND ADOPTION OF E-COMMERCE

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One of the important directions in digitizing economic processes is the need to introduce modern information technologies and e-commerce systems into the public procurement system. The aim of the study is to analyse the stages of digitalization of the public procurement system. The commodity exchange plays an important role in the effective functioning of the public procurement system. The study determined the role of the trading platform, its organizational and legal forms and functions in public procurement through the commodity exchange. The article describes in detail the process of placing an order at the stage of public procurement, as well as the process of fulfilling a contract by a supplier. The article describes the procedure for organizing tenders, the conditions and procedure for participation in tenders. The article provides some suggestions for further improving the public procurement system: development and implementation of a national classification of goods (services) in the public procurement system that meets international and national standards; an increase in the number of operators working in the public procurement information portal system, and, consequently, an increase in the competitive environment, etc.

Keywords: state procurement, digitalization, exchange, trading platform, broker, lot, customer

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РОЛЬ ГОСУДАРСТВЕННЫХ ЗАКУПОК В ЦИФРОВИЗАЦИИ ЭКОНОМИКИ И ВНЕДРЕНИИ ЭЛЕКТРОННОЙ ТОРГОВЛИ

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Одним из важных направлений цифровизации экономических процессов является внедрение систем электронной коммерции в систему государственных закупок. Целью исследования является анализ этапов оцифровки системы государственных закупок. Определена роль торговой площадки, ее организационно-правовых форм и функций при осуществлении государственных закупок через товарную биржу. В статье подробно описывается процесс оформления заказа на этапе государственных закупок, а также процесс выполнения контракта поставщиком. Отмечается, что процесс государственных закупок является нормальным бизнес-процессом, которому присущи риски. Полное или частичное несоблюдение договорных условий в сфере государственных закупок может привести к неэффективному использованию средств государственного бюджета. По этой причине целесообразно ввести систему гарантий, комиссионных платежей и рассрочек для государственных закупок через товарную биржу. При организации системы государственных закупок с помощью электронной торгов практика деления приобретаемых товаров на лоты позволяет снизить риски и сократить расходы. В статье описаны порядок организации тендеров, условия и порядок участия в них. Даются предложения по дальнейшему совершенствованию системы государственных закупок: разработка и внедрение национальной классификации товаров (работ, услуг), соответствующей международным и

национальным стандартам; увеличение количества операторов информационного портала государственных закупок и, следовательно, повышение конкурентной среды среди них и т.д.

Ключевые слова: государственные закупки, цифровизация, биржа, торговая площадка, брокер, лот, заказчик

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Introduction

Each area must be regulated and governed by perfect, popular and strong laws and regulations. An area governed by strong and comprehensive laws and regulations will certainly demonstrate development and growth. Nowadays, much attention is paid to reforms of public procurement. As this sphere is a highly demanding field of modern information technologies, it requires development and constant improvement of normative documents in accordance with the modern requirements [1]. At the current stage of development of the world economy and deepening of the globalization process, the public procurement system is at the second stage of development [2, 3]. The main reason for this is the digitalization of the state procurement system, its exclusion from dependence on the shadow economy [4], and the unhindered participation of small businesses for which it is difficult to withstand the competition in free trade.

Body

The purpose of the research is to analyse the main stages of digitalization of state procurement system and to develop directions for its development [5, 6].

The authors widely employed such methods as grouping theories related to research, modelling in making conclusions made upon research results, statistical analysis, systematic approach, forecasting and generalization methods in the article [7].

The successive development of small business and private entrepreneurship, providing favourable conditions for them can be considered a new stage in further liberalization of the economy carried out by the Government of Uzbekistan [8, 9]. In order to expand the participation of small enterprises in the public procurement system, the Government established a legal framework for this system and is constantly improving it. For example, in 2011, the Presidential Decree on optimizing the public procurement system[1] was adopted; based on it, the Law[2] was adopted in 2018; in 2019 the Decree on the Protection of Private Property[3] was adopted; a draft law on public procurement is currently being developed.

Uzbek Commodity Exchange (UzEx) is the Commodity Exchange of the Republic of Uzbekistan, the operator and owner of the electronic trading system of the exchange, which coordinates and manages trading floors, as well as providing clearing services. UzEx was founded by the Decree[4] of the President of the Republic of Uzbekistan in 1994 and operates in accordance with the legislation of the Republic of Uzbekistan, the Law on the Commodity Exchanges and Commodity Exchanges Activity, the procedure for trading at the Commodity Exchange of the republic of Uzbekistan and internal regulatory documents [10].

In order to create favorable conditions for the further development of small business and private entrepreneurship, it is planned to carry out a number of tasks and functions on public procurement

[1] Resolution of the President of the Republic of Uzbekistan of July 00, 2011 No. PQ-1475 "On optimizing the public procurement system and expanding the participation of small businesses in them"

[2] The Law of the Republic of Uzbekistan of April 9, 2018 No. ZRU-472 "On Public Procurement". URL: https://lex.uz/ru/docs/3648311

[3] Decree of the President of the Republic of Uzbekistan of August 13, 2019 No. UP-5780 "On additional measures to strengthen the protection of private property and guarantee the rights of owners, radically improve the organization of work to support entrepreneurial initiatives, as well as expand the access of business entities to financial resources and production infrastructure". URL: https://lex.uz/ru/docs/4473205

[4] Decree of the President of the Republic of Uzbekistan of February 28, 1994 No. UP-772 "On the abolition of the Uzbek State Joint-Stock Association for Contracts and Trade "Uzkontrakttorg" and the establishment of the Uzbek Republican Joint-Stock Association of Wholesale and Exchange Trade "Uzoptbirzhetorg". URL: https://lex.uz/com/docs/195982

of UzEx. It organizes electronic bidding for public procurement of goods and services included in the appendix to the Presidential Decree:

- purchase of educational supplies (except for educational materials);
- paper and other printing products;
- overhaul and average car repair;
- overhaul and maintenance of residential and non-residential premises;
- computer rental, computing and audio-video equipment;
- operation and maintenance of residential and non-residential premises;
- car maintenance and repair;
- maintenance and repair of furniture and office equipment;
- maintenance and repair of computer, computing, audio and video equipment;
- operation, maintenance and repair of other machinery and equipment.

To accomplish these tasks, UzEx assumes the following functions:

- Exchange – ensures the implementation of new, improved, open and transparent public procurement mechanisms through electronic trading;
- Participation of bidders and observers in an open and transparent auction prevents corrupt contacts and relationships.
- Provides greater participation through the access to the Internet.

The activities of brokers deserve special attention in these tasks. A broker is a member of a stock exchange that deals on behalf of a client. At the same time, brokers are clients and stock exchange traders, in addition to the Clearing House.

Brokers have a number of requirements because of their high responsibility. First of all, they must meet the level of professional training and qualification issued by UzEx and have a professional certificate issued by the State Property Committee of the Republic of Uzbekistan.

The relationship between a client and a broker is carried out on the basis of an assignment agreement or a commission one. Upon entering into the agreement, the broker is obliged to inform the client about the procedure of participation in exchange trading, including the rules of exchange trade and commission fees for brokers and exchange services. After accepting the client's assignments, the broker must fulfil the obligations of the contract as soon as possible. During the assignment, the broker may not disclose the client's name and account number [11]. The broker is obliged to inform the client of the transactions made on the client's behalf in due time. The clients have the right to request information about their personal account from (sub-account) UzEx.

During the first stage of implementation of the mechanism of state procurement, brokers are tasked with providing services to their suppliers [12].

Small businesses and business entities on the one hand and budget organizations which implement state procurement on the other hand work through brokers, and the brokers provide them with all the help they need under the legislation [13, 14]. The brokers are expected to assist the suppliers with registration and with acceptance orders to participate in the sale.

A trading floor is very important for trading activity through the exchange. UzEx trading floors are legal entities that operate on the basis of a contract. They undergo the process of UzEx accreditation and organize the participation in electronic exchange and exhibition-fair trades and will provide contract registration services. The main purpose of the trading floor is to organize participation in exchange and exhibition fairs in order to assist organizations and enterprises in purchasing material and technical resources and goods, and selling their products.

The main functions of the trading floor are:

- providing exchange and exhibition-fair bidders with the access to UzEx single electronic trading system through computer terminals of the trading floor;
- providing advisory and consulting services to brokers and clients of the trading floor;

• registration of domestic, import and export contracts concluded as a result of exchange and exhibition-fair trades;

• information services to participants of exchange and exhibition-fair bidding;

• providing other bidders with other services.

Trading floors are created by legal entities of various organizational and legal forms and various forms of ownership at their own initiative. An applicant organization methodically manages the UzEx trading floor it applied for and bidders while also providing clearing services [15].

The request of the applicant organization and the agreement signed between the it and UzEx *grants the status of UzEx trading floor* and the related powers, rights and obligations. Applicant organization must confirm financial and property proportionality of UzEx trading floor, satisfactory material and technical base and qualification of personnel.

In the first stage of implementation of the mechanism of state procurement, the trading platforms provide services to customers, that is, public and budget organizations. A customer may address the nearest trading platform and get assistance from the trading platform registrar on all trading matters.

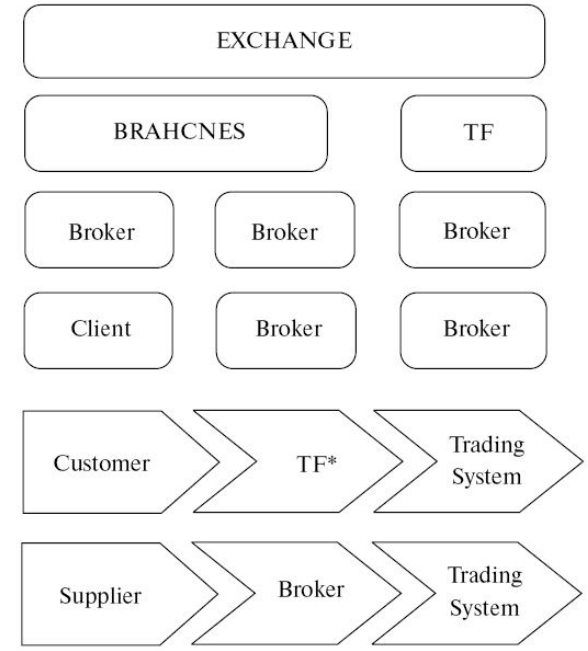

Figure 1. Relationship Scheme

The ordering process at the first stage of state procurement:

• A "Customer" addresses the nearest Trading Floor or a "Broker" attached to it.

• The "Broker" and the "Customer" sign a standard assignment contract.

• The "Broker" takes authority of an "Agent" and acts on behalf of the "Customer" in the system.

The ordering process at the second stage of state procurement:

• A "Customer" addresses an "Agent" accredited on the Exchange or places a representative on the Exchange.

• The "Agent" acts on behalf of the "Customer" in the system.

At the first stage of public procurement, the supplier in the process of the order:

• A "Supplier" selects an appropriate "Broker" through the web-site www.uzex.com.

• The "Broker" and the "Supplier" sign a standard contract.

• The "Broker" acts as an "Agent" on behalf of the "Supplier" in the system.

Figure 2. The process of entry of the supplier into trading

At the second stage of public procurement, the supplier in the order process:

• A "Supplier" applies to an "Agent" accredited on UzEx, or places a representative on UzEx.

• The "Agent" acts on behalf of the "Supplier" in the system.

Here's the order to access and use the Trading System Portal. Access it through the State Procurement Information Portal, then on the portal home page push a large green button with the GZ symbol (in Russian) or DX (in Uzbek).

Orders are provided in the prescribed manner under the following circumstances:

• Budget organizations are required to make purchases through the e-commerce system, when goods and orders range from 300 to 100,000 US dollars.

• To participate in the tender, you can contact an agent accredited on UzEx. The agent places an order or places information on suppliers of public procurement.

• At the first stage, the task of accredited agents is performed by brokers of UzEx.

State procurement is a commercial process, and there is some risk. For example, buyers or sellers of goods may refuse to perform agreed contracts [16]. In addition, the preparation of contracts, their legal reconciliation and coordination with various agencies of the exchange require certain actions and costs from the brokers [17]. If the effectiveness of the time and money is guaranteed to a certain extent by the seller and the buyer, applying to UzEx is in vain and the costs listed above are salvaged [18]. In order to guarantee this process, a part of the contract is anticipated to be paid in advance. If the payment is made, the guarantee amount will be taken into account during the settlement process.

• The budget organization places 0.15% of the amount specified in the agreement as a guarantee, and when the transaction is complete, this amount is used as the exchange and brokerage commission.

• The supplier places its guarantee in the amount of 3%. Upon conclusion of the agreement, the commission is 0.15%.

• In the public procurement system, these funds are used as a guarantee for trade. This is reflected in the sample receipts on the information portal.

Goods purchased by organizations are usually distributed in lots. The way a lot is structured is an important concept for the organizers and suppliers participating in the trade. Proper allocation of lots allows suppliers to significantly reduce prices and meet demand [19]. Brokers should explain to clients the procedure for dividing the goods into lots. If the organization needs repairs, and it is planned to obtain construction, finishing and other materials from the supplier, it is advisable to divide the material into separate lots and place the repair service as an individual lot as well. The greater the number of lots, the lower the cost may be.

It is inappropriate to conclude that by breaking bigger lots into lots with the value below $300 they become unpurchaseable through e-commerce. Electronic bidding for such lots is not prohibited. Of course, if the purchase price is too low, there is a risk the sale costs will not be covered. In other words, it is more economically feasible to limit such trade in order to avoid damage to exchanges and brokers.

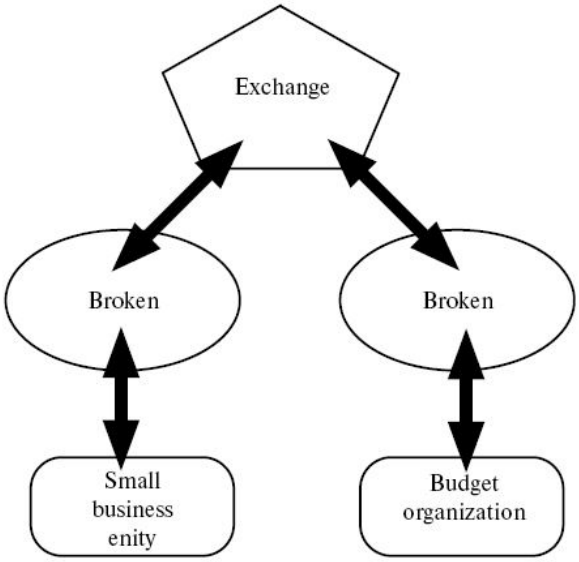

Figure 3. Purchasing goods using electronic bidding

It is advisable to consider the share of brokers and exchanges when doing the calculations.

• The commission of the organization of the bidder and the supplier, that is, both parties, is 0.15%, of which 0.1% goes to the broker and 0.05% to the exchange. Commissions are deducted from the guarantee amount.

• The broker and the stock exchange receive funds automatically and there is no need to transfer them.

Commission incomes should cover all costs of exchanges and brokers, depreciation charges for buildings and various fixed assets, utilities, taxes, internet and all other expenses.

Customer and Supplier Organizations must register participants in the list of exchange to carry out state procurement through the exchange.

• Customers' data are already in the system, and a broker carries out transactions with them through the "customer account management" system.

• Suppliers are registered on iPAY.uz and UZBEX.COM systems. Accounts on state procurement systems are derived from these systems.

Upon completion of the contract, the broker provides the client with an excerpt of the sales record with a seal of brokers of both parties, the details of the participants of the transaction, with a seal of small business product sales centre and macullariat of the commodity exchange of the Republic of Uzbekistan [20]. Then the supplier and the buyer interconnect independently to complete the process and transaction calculations.

Participation in tenders worth more than 100 thousand US dollars is carried out in a different manner. In order to participate in tenders, suppliers must familiarize themselves with the list of tendering procedures on the Public Procurement Information Portal.

An application for participation in a tender can be submitted in accordance with the tender procedures. In addition, in case the applicant is previously registered it is possible to get relevant documents for participation in tenders online. It is possible to get necessary information providing the login and password.

Given that public procurement is an area that needs continuous improvement [21], in order to ensure the convenience of participants in public procurement, the page of the online store of the special information portal now leads to a page of the national store (for budget customers milliydokon.uzex.uz, for corporate customers emilliydokon.uzex.uz), where local customers can make purchases from local manufacturers (manufacturers of products, provision of services).

In order to improve the mechanism of payments in the public procurement and create amenities for participating in electronic bidding, a mechanism for early transfer of funds for the operator's service to the clearing house was introduced.

The Government strives to ensure transparency and further improve the public procurement system. Aiming to ensure and increase targeted and efficient use of funds of business entities and enterprises of strategic importance, as well as widespread involvement of business entities in the public procurement process from January 1, 2020 in accordance with the Decree of the President[5], business entities and enterprises of strategic importance place announcements on a special information portal on public procurement *not later than fifteen days* from the date of receipt of proposals by the selection committee before bidding *by selecting the best offers*. The *protocol* of the *procurement commission* on the selection of the best offers must be placed on the day of its official adoption on a special public procurement portal and remain there *for two business days for public discussion*.

To prevent the participation of enterprises that were declared bankrupt, liquidated or in provisional liquidation, and whose activities were prohibited, the integration of software systems of the special portal of public procurement with tax and other relevant bodies was ensured.

To further improve public procurement, it is advisable to carry out reforms in the following areas:

1. Development of standard forms for public procurement plans, announcements, tenders, contracts, and minutes of procurement committee meetings to ensure uniformity of public procurement documents.

2. Development and implementation and continuous improvement of the national classifier, which combines all the characteristics of goods (services) in accordance with international and national standards; adoption of guidelines for the development, maintenance and continuous improvement of the classifier; creation and implementation of a catalogue of goods (works, services) for public procurement based on the classifier.

3. Digitalisation of tender procedures in order to improve the system of application of modern information technologies in public procurement processes, as well as to increase transparency and transparency in the sector; adoption of guidelines for electronic tenders, the introduction of amendments and additions to the relevant regulations.

4. Encouragement of competition among operators of a special information portal on public procurement, resulting in a further improvement in the quality of services provided by the portal to the public procurement participants.

Conclusions

In conclusion, the gradual introduction of the state procurement system in order to ensure the efficient use of public funds in the conditions of modernization of the economy is beginning to yield positive results.

At present, ensuring competition between the government procurement trading platforms that operate in accordance with regulations and have equal opportunities is important in digitizing the economy.

Ensuring the integration of public procurement trading platforms with the relevant software packages (Public Finance Management Information System, Information Program of the State Tax and Statistical Committees of the Republic of Uzbekistan, etc.) is a strategic task that should be undertaken in the near future.

We believe that developments involving experts in this field, scientists, researchers, practitioners, consumers of the national classifier of products and services, which includes all the characteristics of products and services in accordance with international standards, should be defined as one of the important tasks.

[5] Decree of the President of the Republic of Uzbekistan of January 22, 2018 No. PP-3487 "On measures to support the activities of business entities and enterprises of strategic importance". URL: https://lex.uz/ru/docs/3515545

It is necessary to effectively use the capabilities of the Training Centre under the Ministry of Finance to organize training for specialists in the field of public procurement, as well as attract lecturers from leading countries and national universities for distance education.

To convey the essence of public procurement to business and the public, it is important to encourage various meetings and workshops, as well as promote their widespread media coverage.

It should be noted that this study has several limitations.

Firstly, the data on public procurement in terms of expenditures of the budget recipients are not always in the public domain and such a situation could create some distortion in the studied dependencies.

Secondly, the unstable supply of electricity and poor Internet connection in some remote areas of the country does not allow the full-fledged operation of the electronic exchange trading system, which in the end can significantly affect the practical significance of this study.

Directions for further research

In the near future, deepening of digitization of the economy and coverage of all sectors of the economy will allow to link state procurement e-commerce system for budget organizations to the information system, while informatization of the cost and revenue system of the budgetary organizations will establish electronic links with the state finance system. However, the coherence and adaptation of these systems to each other has not been theoretically analysed. This will encourage further research in this area.

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THEORETICAL ASPECTS OF INNOVATIVE DEVELOPMENT IN CONDITIONS OF ECONOMIC MODERNIZATION: TENDENCIES, ANALYSES AND FUTURE OPPORTUNITIES

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The article reveals the essence of modernization and its high relevance. The authors study world experience of economic modernization and its features in various countries, factors influencing it and principles providing efficient modernization of national economies. The article analyzes the theoretical evolution of scientific concepts dedicated to economic modernization. The article elaborates on the models of economic modernization used in international practice, their criteria, classification, general and specific features of functioning. The article reveals the necessity and problems of economic modernization in Uzbekistan. The Strategy of actions on five priority directions of development of the Republic of Uzbekistan in 2017–2021, considers improving competitiveness of national economy by means of deepening structural transformations, modernization and diversification of its leading industries as the main direction. The authors also analyzed the profitability indicators on the example of some enterprises of different industries and the role of technological progress in production. Sustained economic growth in the world practice of the majority of the developed countries is provided on the basis of innovative factors, by implementation of the program of modernization of national economy and its structural transformations. Developing countries perform a transition to a way of innovative progress on the basis of modernization of economy and diversification of its components. Adoption of a project of modernization of social and economic development of the country is followed by a strategy covering the industry, investments and innovative policy. The object of the research is the economic modernization, innovative processes, trends and prospects of economic development of the CIS countries. The subject of the research is a complex of economic relations arising during the development and implementation of the National Economy Modernization Program. The purpose of the research is development of systematic scientific proposals and practical recommendations aimed at further improving the theoretical foundations of the modernization models of the national economy and increasing the effectiveness of its implementation mechanism. Tasks of Research. describe and classify the modernization of economy as an economic category; research and development stages of scientific concepts of modernization of the economy; analyze the essence, necessity, principles, features and factors of modernization of the economy; classification of economic modernization models by their criteria and their general aspects; studying the experience of applying modernization models used in the world economy and elaborating scientific proposals and practical recommendations on the use of Uzbekistan in practice; development of the priorities of the Uzbek economy's modernization strategy and transition to innovative development; elaboration of alternative scenarios for the acceleration of transition to the modernization of the national economy and the transition to the innovative development in the long term. As a result of the research, the authors present their own definition of modernization of economy as an economic category. Uzbekistan displays modernization of the “catching-up” model. Efficient implementation of this model, introduction of structural transformations creates necessary conditions for implementation of deep structural shifts in national economy. We prove that effective implementation of the program of modernization of national economy and structural shifts require gross investments at a level of 25–35% in the period of 20–30 years.

Keywords: modernization of economy, models of modernization, investments, principles of profitability, technological progress

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ТЕОРЕТИЧЕСКИЕ АСПЕКТЫ ИННОВАЦИОННОГО РАЗВИТИЯ В УСЛОВИЯХ МОДЕРНИЗАЦИИ ЭКОНОМИКИ: ТЕНДЕНЦИИ, АНАЛИЗ И ПЕРСПЕКТИВНЫЕ ВОЗМОЖНОСТИ

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В статье раскрывается сущность модернизации и ее актуальность на сегодняшний день. Изучен мировой опыт модернизации экономики и его особенности в отдельных странах, факторы, влияющие на его реализацию, и принципы, обеспечивающие эффективную модернизацию национальной экономики. В статье анализируется теоретическая эволюция развития научных концепций, посвященных модернизации экономики. В статье раскрывается сущность, модели модернизации экономики, их критерии, классификация, общие и специфические особенности моделей функционирования экономики, которые используются в мировой практике. В статье раскрываются необходимость и проблемы модернизации экономики Узбекистана. Исходя из позиции третьего направления действий Стратегии развития Узбекистана учитывают необходимость модернизации экономики страны. В Стратегии действий по пяти приоритетным направлениям развития Республики Узбекистан в 2017–2021 годах, основным направлением является повышение конкурентоспособности национальной экономики за счет углубления структурных преобразований, модернизации и диверсификации ее ведущих отраслей. А также проанализированы показатели рентабельности на примере отдельных предприятий отраслей экономики и роль технического прогресса в производстве. Устойчивый экономический рост в мировой практике большинства развитых стран обеспечен на основе инновационных факторов, путем осуществления программы модернизации национальной экономики и её структурных преобразований. В странах с переходной экономикой на основе модернизации экономики и диверсификации её компонентов, решаются задачи перехода на путь инновационного прогресса. После разработки проекта модернизации социально-экономического развития страны, сформируется стратегия, охватывающая промышленность, инвестиции и инновационную политику. Объектом исследовательской работы является модернизация экономики, инновационные процессы, тенденции и перспективы экономического развития стран СНГ. Предмет исследования – это комплекс экономических отношений, который имеет место при разработке и реализации Программы модернизации национальной экономики. Цель исследования. Разработка систематических научных предложений и практических рекомендаций, направленных на дальнейшее совершенствование теоретических основ моделей модернизации народного хозяйства и повышение эффективности его механизма реализации. В результате исследования представлено авторское определение модернизации экономики как экономической категории. Модернизация, осуществляемая в Узбекистане, соответствует “догоняющей” модели модернизации. Эффективная реализация данной модели, внесение структурных преобразований создают необходимые условия для осуществления глубоких структурных сдвигов в национальной экономике. Для эффективной реализации программы модернизации национальной экономики и осуществлению структурных сдвигов обоснована необходимость нормы валовой инвестиции в 25–35% и сроки её реализации 20–30 лет.

Ключевые слова: модернизация экономики, модели модернизации, инвестиции, принципы рентабельности, технологический прогресс

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Introduction

Sustained economic growth in the world practice of the majority of the developed countries is provided on the basis of innovative factors, by implementation of the program of modernization of national economy and its structural transformations. Developing countries perform a transition to a way of innovative progress on the basis of modernization of economy and diversification of its components. Adoption of a project of modernization of social and economic development of the country is followed by a strategy covering the industry, investments and innovative policy. Modernization involves technical and technological updating of the leading branches of economy and their improvemen which leads to diversification of production. At the same time, it brings about the issue of the development of the human factor.

In the conditions of modernization of national economy, "... establishment of an innovative program, training of a new generation of personnel effectively using innovations and investments, support of owners become essential. For this purpose, it is necessary to think deeply over a national idea, a national program of technological development of Uzbekistan and modernization of the domestic market. Implementation of this program has to create new opportunities for Uzbekistan to find its worthy place among the developed countries of the world [1]. Modernization of national economy and implementation of structural transformations are a priority direction in achievement of these long-term goals. The Strategy of actions on five priority directions of development of the Republic of Uzbekistan in 2017 2021 considers "improving competitiveness of national economy by means of deepening structural transformations, modernization and diversification of its leading industries" as the main direction [2, 3].

The object of the research is the process of modernization of the economy in the Republic of Uzbekistan.

The subject of the research is a complex of economic relations in modernization of the economy in the Republic of Uzbekistan.

The purpose of the research is development of systematic scientific proposals and practical recommendations aimed at further improving the theoretical foundations of the modernization models of the national economy and increasing the effectiveness of its implementation mechanism.

The tasks of the research are:

- to describe and classify the modernization of economy as an economic category;
- to analyze the essence, principles, features and factors of the economy modernization;
- to classify economic modernization models by the criteria applied and general principles;
- to study the experience of applying modernization models used in the world economy and elaborate scientific proposals and practical recommendations on their use in Uzbekistan;
- to elaborate alternative scenarios for acceleration of the transition to the modernization of the national economy and to the innovative development in the long term.

Research methods

Some theoretical, practical and quantitative aspects of modernization of national economy are explored in works of foreign scientists, such as W. Rostow, R. Inglehart, A. Maddison, R. King, J. Natanson, A. Lewis, H. Chuanqi, H. Yamawaki, R. Wade[1], P. Romer, as well as scientists of the neighboring countries, such as A. Amosov, O. Golichenko, V. Dementiev, D. V. Didenko, L. Yevstigneyeva, R. Yevstigneyev, V.A. Krasilshchikov, V. Mau, R. M. Nureev, N. Obukhov, I. A. Pogosov, V. Polterovich, B. A. Heifetz, K. Hubiyev and others [4–30, 37, 38]. They analyzed modernization of production in the countries of transition economy. In this scientific research, the authors reveal features of models, driving forces and national strategies of economic modernization and systematize mechanisms of their implementation.

World practice shows the increased power and material consumption, capital intensity of products, insufficient use of modern technologies has negative impact on competitiveness of production in the country. Acceleration of the processes of modernization carried out in economy, deep analysis of theoretical and conceptual aspects of implementation of structural transformations, comparative analysis of the best

[1] https://en.wikipedia.org/wiki/Robert_Wade_(scholar)

practices of implementation of programs of modernization of national economy in the developed countries, research of a possibility of creative application of this experience for improvement and increase in efficiency of modernization strategy in Uzbekistan have a special scientific and practical value. In economic literature, the category "modernization of economy" was analyzed in relation with such terms as "innovation", "diversification", "sustainable economic growth", "transitional economy", etc. [4–7, 31–36].

In the course of formation of the market relations in transition countries, the theories of modernization were practically not applied while the terms "reform" and "a transitional (transit) economy" were in used in most cases. We elaborate on the idea that in the course of economic reforms, separate market institutions are unable to provide effective economic development, so such terms as "modernization", "structural transformations", "national competitiveness" are required. World experience shows modernization in many countries often began as a national program [3, 8–14, 32].

The category of "modernization of economy" and its mechanism were studied in interrelation with such terms as "industrialization", "innovation", "liberalization of economy", "diversification of economy", "human capital", "national net wealth". As a result, the interrelation of these concepts allowed to disclose characteristics of the category and the factors that promoted determination of economic regularity of modernization of economy.

Modernization and diversification of industries of the real economy are necessary to improve the overall economic competitiveness. In this case, modernization coincides with diversification processes in time, so this direct connection lead to innovative development. As a result of the use of high technologies, innovative development promotes production of goods with high added value and increases export volumes. It also provides sustainable economic growth and competitiveness of national economy due to growing national net wealth. As for competitiveness of national economy, it guarantees an increase in living standards of the population.

It is possible to characterize the category of economic modernization proceeding from specific features of each country.

Table 1. Characteristics of the category of economic modernization*

Sphere of specific features	Characteristics
Economy	Industrial economy, high rates of economic growth, the increased intellectual capacity, innovative development
Society	Standards of living, state of health of the population, urbanization, employment rate
Personality	Initiative, business, innovation, education, belief
State	Democracy, constitution, bureaucracy

*Source: the authors' data

Features of modernization in different spheres are shown in Table 1. The category of modernization covers all spheres of activity of society, in particular, economic and social aspects of life.

Analysis of world practice shows modernization can be conditionally divided into two types. The first type is an institutional modernization, or modernization of social life. It generates ample opportunities for creation of innovations by means of intellectual development of various classes and groups. The second type of modernization is a technological modernization, or acceleration of economic diversification and promotion of production policy. In this case, a boost of investments in the fixed capital of the real economy ensures transition to industrial economy. Measures to increase a share of production in the GDP of a national economy are taken.

In both cases co-dependence between subjects of modernization, that is between state, society and business, is an important aspect. The dependence between subjects can be direct or opposite.

A state protects and guarantees the rights of people, members of the society, provides freedom to business and creates a favorable environment. The society contributes to the socio-political development of the state, creates innovative projects for business and also sets business in motion as a human resource and serves to the state as labor. Business increases financial income of the state, leads to accumulation and growth of the capital of the members of the society. Social cooperation in achievement of cost efficiency of interrelation of the mechanism is important.

The purpose is to catch up with the level of social and economic development of the developed countries by means of modernization, and to protect the benefits of all subjects equally. Economic literature presents various points of view concerning the category of modernization.

V. Gelman understands modernization of economy as a set of measures, aimed at economic growth, increase in the standards of living and development of the human capital. A drawback of this definition is that a set of measures in not enough for modernization, it requires their correct implementation.

E. Yasin claims economic modernization is "an achievement of international competitiveness of a country in general and of a wide range of its industries for the purpose of providing sustainable development of economy and a worthy place among the most prospering nations". This definition of modernization most fully discloses its content since it ensures sustainable development and promotes an increase in rates of growth in real economy including industrial sector.

V. Krasilshchikov gave a more complete definition to the category of modernization. In his opinion, "generally, modernization can be defined as a set of public and technological changes made to advance society to the state and level of development reached by the leading countries of Western Europe and North America, as well as Australia and New Zealand at the beginning of the second half of the past century" [32]. The definition provides no specific features of the state where the program of modernization will be carried out. It is impossible to achieve the expected result by mechanical transfer of experience of some countries. According to certain economists, the conceptual idea of economic modernization is for the state "to admit an economic, technological and institutional lag, and the need for its transition to the new level of development". In this definition the explanation of a concept of a lag is necessary. Today, modernization for the purpose of formation of the society based on innovative modernization of economy, technological, economic and socio-political paradigm is considered as complex changes.

Modernization of economy as economic category acquires wider contents, than technical and technological updating. Disclosing the distinctions between modernization and updating, B. Hakimov systematized modernization on various attributes [35].

A certain group of economists applies the categories of "modernization" and "innovation" in a generalized view as a concept of "innovative modernization". The second group of economists defines "modernization of economy" as one of the stages of transition to a way of innovative development. The third group of economists accepted Western Europe as a standard for modernization of economy. We can give the following definition of modernization of economy as an economic category:

Modernization of economy is a continuous process consisting of measures of ensuring steady growth rates of various sectors of economy on the basis of improvement of production factors.

To determine similarities and differences between models of modernization of economy, we estimated the following attributes: terms of implementation of the project of modernization of economy, a role of the state in economic processes and influence of driving forces of modernization.

According to the criteria of similarity and difference between them, we can divide the models of modernization of economy in the following groups (Table 2).

Table 2. Criteria of models of modernization of economy*

Criteria / Model	Organic model	Catching-up model	Revolutionary model
Role of the state	Providing regulation	Top-level	Top-level

Terms	20–25 years	20–25 years	15–20 years
Driving factors	Endogenous (internal)	Endogenous, exogenous	Exogenous (external)

*Source: the authors' data

Table 2 shows "organic" and "catching-up" models of modernization of economy require 20–25 years.

The state plays a prominent role in the "catching-up" and "revolutionary" models and exogenous factors have a high impact.

In particular, if the "revolutionary" model develops generally at the expense of external debts, the "catching-up" one proceeds due to endogenous factors and exogenous DFI (direct foreign investments).

Features of the "catching-up" model are as follows:

1. During modernization the state acts as the initiator and organizer of economic reforms, and using efficient regulation directs all the efforts to engage investments and implement of the industrialization policy.

2. It is necessary to rely on driving forces of modernization to maximize the output of the agricultural sector after the stages of industrialization and post-industrialization.

Table 3. Industry structure of GDP (as a percentage)[2]

Indicators	2000	2005	2010	2015	2016	2017	2018	Changes in 2000-2018
Gross added value of the industries	87.5	89.4	90.8	91.2	91.3	89.8	88.8	1.3 p.p.
Manufacturing*	14.2	21.1	23.9	25.7	25.7	30.1	32.0	11.8 p.p.
Construction	6.0	4.8	6.5	7.3	7.2			
Agriculture*	30.1	26.3	18.0	18.3	17.6	17.2	32.4	2.3 p.p.
Transport and communication	7.7	10.6	11.5	12.2	12.5	42.5	35.6	-1.6 p.p.
Trade and public catering	10.8	8.8	9.2	10.3	10.5			
Other industries	18.7	17.8	21.7	17.4	17.8			

* According to data of the State Committee of statistics of the Republic of Uzbekistan, since 2015 the gross added value of manufacturing is considered together with construction, agricultural together with fishing and forest industries.

During 2005–2017 the average annual growth rate of GDP in Uzbekistan was more than 7%, and these steady rates of economic growth provided corresponding increase in gross domestic product per capita. As the industry structure of GDP and the dynamics of a contribution of the different industries to ensuring GDP growth show, the national peculiarity of modernization of economy begins with industrialization (Table 3).

Table 3 shows that in 2000–2018 the gross added value of the industries grew by 1.3 p.p. (percentage point), the production share grew in a corresponding way by 11.8 p.p., the added value of agriculture by 2.3 p.p. During the analyzed period the manufacturing growth rates were higher than the growth rates of agriculture, thus, the share of manufacturing increased in structure of GDP.

The "catching-up" model uses import-substituting and export-oriented strategies. The import-substituting strategy provides replenishment of domestic markets due to diversification of the industry and only after that provides export-oriented strategy. The international industrial cooperation becomes the main criterion in export-oriented strategy.

[2] It is made on the basis of data of Committee on statistics of the Republic of Uzbekistan.

The concept of "strategy of modernization of economy" is meant as a change of economic policy of the state and communication between the institutes carrying out this policy at a certain stage. The strategy of modernization of economy interacts with legal-institutional changes. In this case, problems of modernization of national economy are defined and the directions of the solution of these problems on the basis of peculiar features are developed. The goals to be achieved in the terms specified in the strategy of modernization of economy are defined precisely. In particular, adoption of the national program of technological development of Uzbekistan and modernization of internal market allow to create new opportunities for Uzbekistan to take a worthy place among the developed countries of the world. This strategy presupposes that GDP per capita will double by 2030 and a share of manufacturing (together with the construction industry) will increase from 32% in 2018 up to 40%.

On the basis of modernization of economy and structural changes "... we pass to a way of the innovative development aimed at radical improvement of all spheres of life of the state and society" [1].

Institutional changes and reforms in these areas have direct influence on modernization of economy. Therefore, the efficiency of activity of the state and the enterprises which are the main subjects of economy depends on society. Creation of new or improvement of the existing institutions provide modernization of society. By this we mean modernization of all spheres of society, in particular, modernization of the society itself. World experience shows the strategy of modernization of national economy has to be flexible, i.e. it has to adapt to domestic and international market changes in due time.

As for achievement of a steady rate of economic growth for effective implementation of the concept of modernization of economy it is necessary to lean on one of the following approaches:

1. Achievement of steady growth rates of national economy by improvement of institutional bases of modernization.

2. Steady rates of economic growth contribute to the development of institutional infrastructure serving modernization of national economy.

As for improvement of legal bases of modernization of society and economy of Uzbekistan, the development and adoption of the bill "About Modernization" is required.

This law, in our opinion, will give an opportunity to provide a legal and institutional basis for modernization of national economy and acceleration of processes of modernization.

Investment policy has importance for the strategy of modernization of economy, investments are one of its driving forces. "Without investments there is no progress, no technical, technological updating and modernization of production and the country in general". Investments in fixed capital play a leading role in the national investment policy. Sources of investments in fixed capital in 2000–2018 and changes of their structure in branches of economy (Tables 4–5) are given below.

Table 4. Investments into fixed capital on financing sources (as a percentage)

Financing sources	2000	2005	2010	2015	2016	2017	2018	Changes in 2000-2018
Republican budget	29.2	12.2	5.6	4.5	4.5	5.5	3.9	-25.3 p.p.
Means of the enterprises and population	39.1	57.5	49.0	52.9	53.0	43.9	39.4	0.3 p.p.
Bank credits and other borrowed funds	7.2	3.8	9.7	11.8	11.1	11.0	14.9	7.7 p.p.
Foreign investments	23.2	21.7	28.3	19.9	21.3	26.9	13.8	-9.4 p.p.
Means of off-budget funds	1.3	4.8	7.4	10.9	10.1	12.7	28.0	26.7 p.p.

Table 4 shows in 2000–2018 the share of investments from the republican budget into fixed capital decreased by 25.3 percentage points. Investments of the enterprises and the population in 2000–2018 increased by 0.3 percentage points. The analysis suggests growth of investment activity of the enterprises

and the population which are the leading source of financing of modernization. Off-budget investments into fixed capital, including fund of reconstruction and development, significantly increased. In 2018 extrabudgetary share funds increased by 26.7 percentage points in comparison with 2000.

As data testify, in 2000–2017 the share of public sector significantly decreased from 63.9% to 24.7%, or by 39.2 p.p. The share of the non-state sector on the contrary increased from 36.1% up to 75.3%.

The manufacturing industry has to take the leading place in structure of GDP during modernization of economy. In 2005–2018 Uzbekistan reached prompt and steady rates of economic growth in such industries of real economy as manufacturing, agriculture, construction, transport and communication. As you can see, these rates of economic growth were due to investments to fixed capital of those industries.

In 2000–2018 the manufacturing industry had the leading place in the investments to fixed capital, including of foreign investments (Table 5).

Table 5. Structure of investments into fixed capital on branches of economy[3]

Name of the branches	2000	2005	2010	2015	2016	2017	2018	Changes in 2000-2018
Manufacturing	29.7	32.6	30.4	40.9	39.4	48.8	52.3	22.6 p.p.
Agriculture	5.7	4.4	3.5	3.3	3.3	3.3	3.3	-2.4 p.p.
Transport and communication	16.8	24.1	29.7	11.2	13.8	11.8	8.3	-8.5 p.p.
Housing construction	13.0	11.0	15.1	21.9	22.3	17.9	16.5	3.5 p.p.
Other industries	34.8	27.9	21.3	22.7	21.2	18.2	19.6	-15.2 p.p.
Including, the foreign investments to fixed capital								
Manufacturing	62.4	46.4	23.6	70.8	87.8	74.0	82.9	20.5 p.p.
Transport and communication	24.7	38.7	68.3	20.5	8.4	19.0	7.0	-17.7 p.p.
Agriculture*	4.6	3.0	0.9	0.8	1.0	7.0	10.1	*
Other industries	8.3	11.9	7.2	7.9	2.8			-2.8 p.p.

* Investments to agriculture, in structure in other industries, in 2017–2018.

Table 5 shows an increase in investments to fixed capital in the manufacturing industry by 22.6 percentage points and by 3.5 p.p. in construction in 2018, in comparison to 2000. In 2018 the investments to fixed capital in the industries of transport and communication decreased by 8.5 percentage points, foreign investments in the industries decreased by 17.7 p.p.

During the analyzed period, foreign investments to fixed capital of the manufacturing industry grew by 20.5 percentage points. It proves that the state pays special attention to the manufacturing investment policy.

Table 6. Technological structure of the investments to fixed capital in 2000–2018[4]

Structure \ Years	2000	2005	2010	2015	2016	2017	2018	Changes in 2000-2018
Total (percentage)	100	100	100	100	100	100	100	
Building and construction works	58.1	48.7	52.1	54.9	56.9	60.3	49.7	-8.4 p.p.
Equipment and stock	30.6	38.7	39.0	34.0	35.4	31.5	39.7	9.1 p.p.
Other capital works and expenses	11.3	12.6	8.9	11.1	7.7	8.2	10.6	-0.7 p.p.

[3] The statistical year-book – T.: 2007. Page 289, 297.; 2013. Page 257, 265. Construction in Uzbekistan T.: 2017. Page 52, 53.

[4] Almanac Ўзбекистон 2013. T., 2013. It is calculated according to Center for economic research. The statistical collection construction in Uzbekistan. T., 2017. C.33; Economic and social situation of the Republic of Uzbekistan for 2017. T., 2018. 69 pages.

Table 6 shows in 2000–2018 along with an increase of investment to the equipment and stock by 9.1 percentage points, there is also a notable decrease in a share of investments to fixed capital and on installation and construction works. This situation is connected with an emergence of new high-tech industries in national economy that, in turn, can lead to growth of an active part in structure of fixed capital in economy. In the investments in fixed capital in 2000, installation and construction works made 58.1%, the equipment and stock 30.6%, and in 2017 installation and construction works increased by 60.3%, the equipment and stock by 31.5%.

In our opinion, investments should not be directed entirely on construction of new objects, it is preferable to direct them to modernization of the hi-tech processing plants which promotes the structure of investments, increases output and efficiency.

The results of the research show that modernization is closely connected with structural transformations. Annual GDP growth is related to growth rates of its industries, increase in production of industrial goods, volume of investments, status of fixed assets, share of population employed in branches of economy, etc. The Strategy of actions on five priority directions of development of the Republic of Uzbekistan in 2017–2021 sets a goal to increase a share of processing industry in manufacturing in 2021 up to 85%. By our calculations, to achieve this goal the share of the processing industry in manufacturing in 2018 has to increase up to 81.6%, in 2019 up to 82.4%, in 2020 up to 84.4%. In 2021 the output of manufacturing has to increase by 1.5 times in par value, in comparison with 2017, while the volume of processing industry will increase by 1.6 times.

Conclusions

On the basis of the research the authors can submit the following conclusions:

1. Modernization of economy is an economic category related to a certain social and economic system with economy acting as the system in the whole, and the state, society and the individuals being its subjects. The authors define the category of modernization of economy as follows: "Modernization of economy is a process consisting of complex measures aimed at sustainable development in branches of economy on the basis of improvement of factors of production". This advanced theoretical approach to category of modernization of economy gives an opportunity to improve conceptual bases of modernization of economy and to define priority directions of its implementation.

2. Use of methodological recommendations to define and classify endogenous and exogenous factors influencing the process of modernization of economy promotes improvement of methodological bases for programs of modernization in the leading branches of economy and its structural transformations.

3. The methods to assess distinction criteria of models of modernization of national economy on the basis of driving forces promotes improvement of methodological bases for target state programs of modernization of the leading industries, and spheres of national economy and the mechanism of their implementation.

4. Trends and features, driving forces of the "organic", "revolutionary" and "catching-up" models of modernization of economy and criteria of distinctions, conditionality of strategy of modernization of economy of Uzbekistan to changes, increase of high technologies in the branches of economy, definition of the directions based on innovative development gives an opportunity to modernize Uzbekistan's economy to ensure sustainable development of the country from the socio-political point of view and define strategic objectives of structural changes.

5. We prove that effective implementation of the program of modernization of national economy and structural shifts require gross investments at a level of 25–35% in the period of 20–30 years.

6. Uzbekistan displays modernization of the "catching-up" model. Efficient implementation of the "catching-up" model of economy, introduction of structural transformations creates necessary conditions for implementation of deep structural shifts in national economy.

7. Proceeding from requirements of modernization of the manufacturing industry and structural transformations and diversification in investment policy of Uzbekistan, in technological structure of the investments involved in economy, it is necessary to bring the ratio between installation and construction works and a share of the equipment and stock to 1:2. In this case the main attention needs to be paid to resource-saving, high-tech means, production of import-substituting goods that will promote effective use of investments.

8. Development and adoption of law "About Modernization" will give an opportunity to provide a legal and institutional basis for modernization of national economy and acceleration of processes of modernization.

9. The Strategy of actions on five priority directions of development of the Republic of Uzbekistan in 2017–2021 sets a goal to increase a share of processing industry in manufacturing in 2021 up to 85%. To achieve this goal the share of the processing industry in manufacturing in 2018 has to increase up to 81.6%, in 2019 up to 82.4%, in 2020 up to 84.4%. In 2021 the output of manufacturing has to increase by 1.5 times in par value, in comparison with 2017.

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OPTIMAL RISK MANAGEMENT TECHNOLOGY AS A TOOL FOR ENSURING THE RELIABILITY OF SOLUTIONS MADE IN THE DIGITAL ECONOMY

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The modern stage of risk management development is marked by discrepancy between the implemented risk management systems and the real risk situation, and the degree of their impact on the goals, results and effectiveness of organizations. Based on the principles of the process approach and the digital paradigm of risk management, the concept of optimal risk management was formulated for the first time and a technology for its implementation was proposed by optimal structural and parametric synthesis of unstructured integrated risk management system, taking into account the methods and extent of risk treatment. Optimal management is considered as a problem of optimal structural and parametric synthesis of RMS using effectiveness criteria - optimality criteria or excellence criteria, depending on the purpose and statement of the problem. The problem belongs to the class of multiextremal nonlinear programming problems with distributed variables of mixed type and functional constraints in the form of inequalities, which was solved using digital risk assessment methods developed by the author, global random search procedures and mixed-integer optimization models of block type. To assess the comparative effectiveness of risk treatment methods, a modification of the Houston model was developed according to the criterion of the value of organization, provided that the goal was achieved and resources were limited. An important difference in the Houston model modification is the cost assessment of risk in terms of the "cost of risk". The author's research and the practice of optimal design show that the use of structural and parametric optimization technology and mixed-integer optimization models of block type can lead to a significant, on average, 50-60%, increase in the RMS effectiveness. The new digital risk management paradigm is logical, reflects the result of modern digital technologies introduction in risk management practice, provides for the rejection of the hypothesis about the normal distribution of the output parameters of the ecosystem under study, and the preservation of the required information content of the "digit" in the context of process approach. The use of digital technologies and methods of optimal risk management provides the reliability of economic solutions important for practical purposes and provides new opportunities for effective management in the digital economy.

Keywords: Optimal risk management concept, process approach, integrated risk management system, optimal structural and parametric synthesis, digital method of risk assessment, risk level, cost of risk

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ТЕХНОЛОГИЯ ОПТИМАЛЬНОГО УПРАВЛЕНИЯ РИСКАМИ КАК ИНСТРУМЕНТ ОБЕСПЕЧЕНИЯ ДОСТОВЕРНОСТИ ПРИНИМАЕМЫХ РЕШЕНИЙ В ЦИФРОВОЙ ЭКОНОМИКЕ

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Современный этап развития риск-менеджмента характеризуется несоответствием внедряемых систем управления рисками реальной ситуации рисков и степени их влияния на цели, результаты и эффективность деятельности организаций. На основе принципов процессного подхода и цифровой парадигмы менеджмента риска впервые сформулирована концепция оптимального управления рисками и предложена технология ее реализации путем оптимального структурно-параметрического синтеза интегрированной системы управления рисками произвольной структуры с учетом способов и объема воздействия на риск. Оптимальное управление рассматривается как задача оптимального структурно-параметрического синтеза СУР с использованием критериев эффективности — критериев оптимальности или критериев превосходства, в зависимости от цели и постановки задачи. Задача относится к классу многоэкстремальных задач нелинейного программирования с распределенными переменными смешанного типа и функциональными ограничениями в виде неравенств. Для ее решения использованы разработанные автором цифровые методы оценки риска, процедуры глобального случайного поиска и частично целочисленные оптимизационные модели блочного типа. Для оценки сравнительной эффективности способов воздействия на риск разработана модификация модели Хаустона по критерию стоимости организации при условии достижения цели и ограниченности ресурсов. Важным отличием модификации модели Хаустона является стоимостная оценка риска по показателю «цена риска». Исследования автора и практика оптимального проектирования показывают, что использование технологии структурно-параметрической оптимизации и частично-целочисленных оптимизационных моделей блочного типа может привести к существенному, в среднем на 50–60%, повышению эффективности СУР. Новая цифровая парадигма управления рисками является закономерной, отражает результат внедрения современных цифровых технологий в практику управления рисками, предусматривает отказ от гипотезы о нормальном распределении выходных параметров исследуемой экосистемы и сохранение требуемой информативности «цифры» в условиях процессного подхода. Применение цифровых технологий и методов оптимального управления рисками обеспечивает важную для практических целей достоверность принимаемых экономических решений и открывает новые возможности для эффективного управления в цифровой экономике.

Ключевые слова: концепция оптимального управления рисками, процессный подход, интегрированная система управления рисками, оптимальный структурно-параметрический синтез, цифровой метод оценки риска, уровень риска, цена риска

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Introduction

As a result of rigorous research, the worldwide gathered experience of risk management allows decision-makers to influence the achievement of goals, justify and apply effective tools and risk treatment methods in the management of organizations, projects and business processes [1–4].

International and national ISO standards for risk management[1,2,3,4] have been developed and are constantly being improved, the current legal regulatory documents establish requirements for the development and implementation of integrated risk management systems of organization [5, 6], and existing risk management methods are increasingly used in projects and risks management [7]. The risks impact on the performance of organizations, investment projects and programs is constantly growing, and the high cost of risk often becomes the determining factor in making managerial decisions [8].

Alongside this, the modern stage of risk management development is marked by discrepancy between the implemented risk management systems and the real risk situation, and the degree of their impact on

[1] ISO 31000:2018 Risk management – Guidelines

[2] IEC 31010:2019 Risk management – Risk assessment techniques

[3] GOST R ISO 31000-2010 Risk Management – Principles and Guidance

[4] GOST R ISO/IEC 31010-2011 Risk Management – Risk assessment techniques

the goals, results and effectiveness of organizations. For a host of reasons, the risk level for entrepreneurial activity of organizations in Russia is significantly higher compared to economically developed countries [9], which causes an increase in risk tension and risk appetite for participants in entrepreneurial activity, thereby, causes the need to develop and implement integrated risk management systems (RMS).

The risk of organization is defined as a consequence of the uncertainty impact on the goals, results and effects of an organization's entrepreneurial activity, implementation of projects and business processes.

Current problems of the theory and practice of organization risk management are:

- reliability of existing standardized procedures and methods for describing, identifying and assessing risks, insufficient for practical purposes;
- poor development and implementation in risk management practice of a process approach requiring the full integration of risk management in the organization's activities, project and business process management;
- lack of standardized methods for optimal risk management and RMS synthesis under conditions of uncertainty of existing risk factors;
- insufficient skill level of persons responsible for the RMS development and implementation;
- the lack of public information about the positive results of risk management of organization;
- level of digital models and risk management methods development insufficient for the purposes of the digital economy;
- inconsistency of the RMS implemented with the real risks situation, the existing factors and the degree of their impact on the goals, results and effectiveness of organizations' activities.

The goal of research is to develop the concept of optimal risk management of organization and the technology of its implementation based on the optimal structural and parametric synthesis of RMS with distributed parameters in the digital economy format.

The digital economy means an economic activity in which key factor of production are data in digital form, processing of large volumes and use of analysis results, which, in comparison with traditional forms of managing, can significantly increase the efficiency of different types of production, technologies, equipment, storage, sale, delivery of goods and services [10–12].

The "digital economy" term was used for the first in 1995 by Nicholas Negroponte, American scientist from the University of Massachusetts, to explain the advantages of the new economy compared to the old one due to the intensive development of information and communication technologies.

According to the Digital Evolution Index 2017 research, Russia has good prospects to take a leading position in the ranking of the digital economy development. According to expert opinion, despite the relatively low overall level of digitalization, our country shows sustainable growth rates and is at the height of digital development, thereby attracting investors to the economy.

Optimal risk management concept

The results of the author's research show that the optimal risk management concept of organization can be successfully implemented only from the perspective of a systemic economy [13–16], based on a process approach, a digital paradigm and project management technology [17].

This paper proposes the technology for implementing the optimal risk management concept through optimal structural and parametric synthesis of unstructured RMS, taking into account the methods and extent of risk treatment. The problem belongs to the class of multiextremal nonlinear programming problems with distributed variables of mixed type and functional constraints in the form of inequalities, which was solved using digital risk assessment methods [18] developed by the author, global random search procedures [19] and mixed-integer optimization models of block type [20].

The effectiveness of RMS, methods of risk treatment and risk management measures is determined by the content of the RMS development process, which at each stage of development and implementation

is a problem solving related either to the synthesis or analysis of RMS, without and taking into account the risk treatment (Fig. 1). Thus, synthesis and analysis act in the process of RMS development and implementation in dialectical unity.

Optimal management is considered as a problem of optimal structural and parametric synthesis of RMS using effectiveness criteria – optimality criteria or excellence criteria, depending on the purpose and statement of the problem.

The RMS development according to the completed task begins with the synthesis of the structure – generation of the original variant of the RMS, according to the results of which the parameters of the system elements are set and the transition to the analysis procedure is performed. Further, verification of compliance with established requirements, including goals, effectiveness and efficiency is performed.

If it is necessary to choose the best method of risk treatment with regard to accepted criterion, then the optimal synthesis of RMS is considered, which is based on the procedures of structural, parametric or structural and parametric optimization.

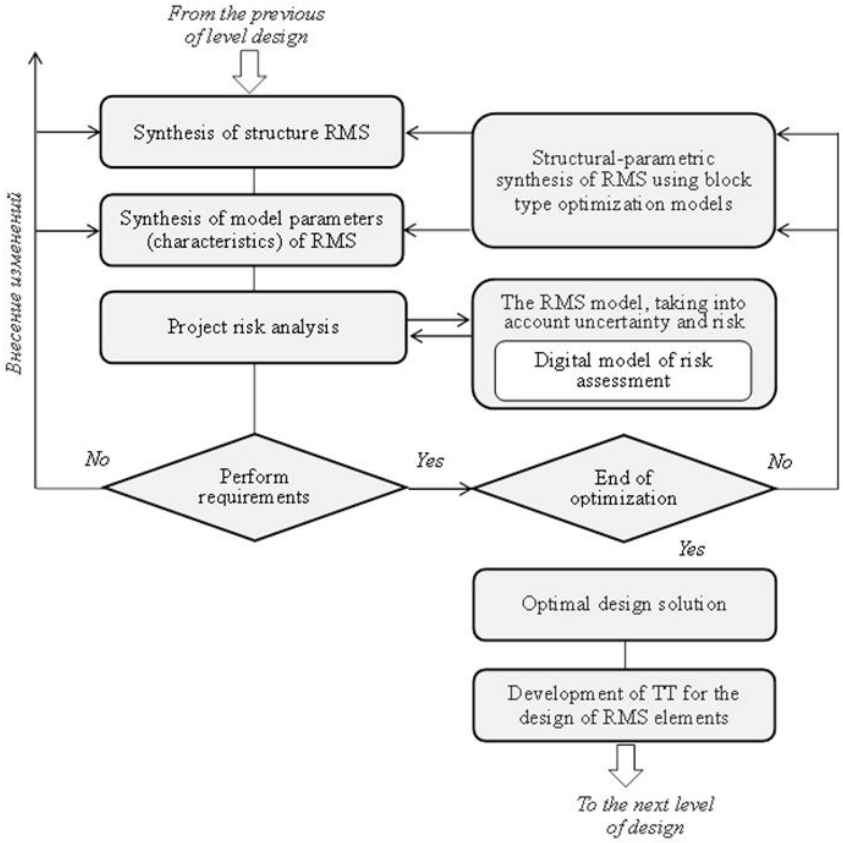

Figure 1. Development RMS

The solving of the structural and parametric optimization problem within the unified simulating algorithm is focused on obtaining optimal values of discrete parameters $X=\{x_1,...,x_n\}$, which reflect the structure, and continuous parameters $Y=\{y_1,...,y_m\}$, which represent the characteristics of RMSs, which are integer and real variables, respectively.

Implicitly, the statement of the problem of structural and parametric optimization based on mixed-integer optimization models of block type has the form:

$$F(X, Y) \rightarrow \min , \quad (1)$$

restrictions $R(X, Y) < R^*$

$$x_i^{min} \le x_i \le x_i^{max}, i = 1, ..., n$$

$$y_j^{min} \le y_j \le y_j^{max}, j = 1, ..., m,$$

where the optimality criterion (1) displays the costs for the development and implementation of an integrated risk management system, taking into account the risk treatment, as well as while providing the set conditions for implementation and the required risk level of the R* project.

A distinctive feature of problem solving is the almost simultaneous generation of values of integer and real variables, as well as the use of a special mathematical method for determining the global extremum of the objective function (1).

When generating RMS variants, the principle of variables blocking is implemented [20], according to which integer variables are combined into a block of so-called connecting variables. Depending on this block composition, values of real type variables are further generated.

Extremum of the objective function is determined by one of the global random search procedures related to the generation method. The algorithm for global random search for extremum is based on three main principles:

1) the best points from previously obtained ones are used to find new points;

2) the number of calculations of the objective function near the one of previously obtained points depends on the value of the function at this point;

3) as the point of global extremum nears, the "scope" of the search does not increase.

The author's research and the practice of optimal design show that the use of structural and parametric optimization technology and mixed-integer optimization models of block type can lead to a significant, on average, 50–60%, increase in the RMS effectiveness.

Comparative effectiveness of risk management methods

In some cases, it is advisable to use the excellence criteria in the form of inequalities to analyze the comparative effectiveness of risk treatment methods and simplifying the problem of optimal management.

The most common methods of organization's risks treatment are (Fig. 2): risk insurance; reservation of funds (self-insurance); securing a public procurement contract; formation and use of funds of the SRO compensation fund; irrevocable bank guarantee and some others.

In world practice, as a rule, either a risk insurance system or reserve funds (self-insurance) are used — in an amount necessary and sufficient to cover the expected shortfall (damage, losses). Compensation fund of self-regulatory organizations (SRO) for risk management is not formed and is not used.

Assessment of the comparative effectiveness of insurance and reservation is based on the method, which in Western literature is called the Houston method [21].

The essence of this method is to assess the impact of various risk management methods on the value of organization, which is determined through the value of the organization's free (net) assets — the difference between the value of all its assets and liabilities.

To assess the comparative effectiveness of risk treatment methods, a modification of the Houston model was developed according to the criterion of the value of organization, provided that the goal was achieved and resources were limited. An important difference in the Houston model modification is the cost assessment of risk in terms of the "cost of risk". The choice of risk management method is based on the criterion of comparative economic efficiency of insurance and reservation in the form of:

$$C_s > C_r, \quad (2)$$

where C_s — the value of organization, taking into account risk insurance;

C_r — the value of organization, taking into account the reservation.

If there is a inequality, risk insurance is more effective, otherwise, the formation and use of the reserve fund.

Despite the universality and widespread use of entrepreneurial risk management in the world practice, the Houston method has some material weaknesses. Thus, with various methods of risk management, the economic meaning of risk and its consequences is often lost, a description of risk factors is not provided, and an economic risk assessment is not performed.

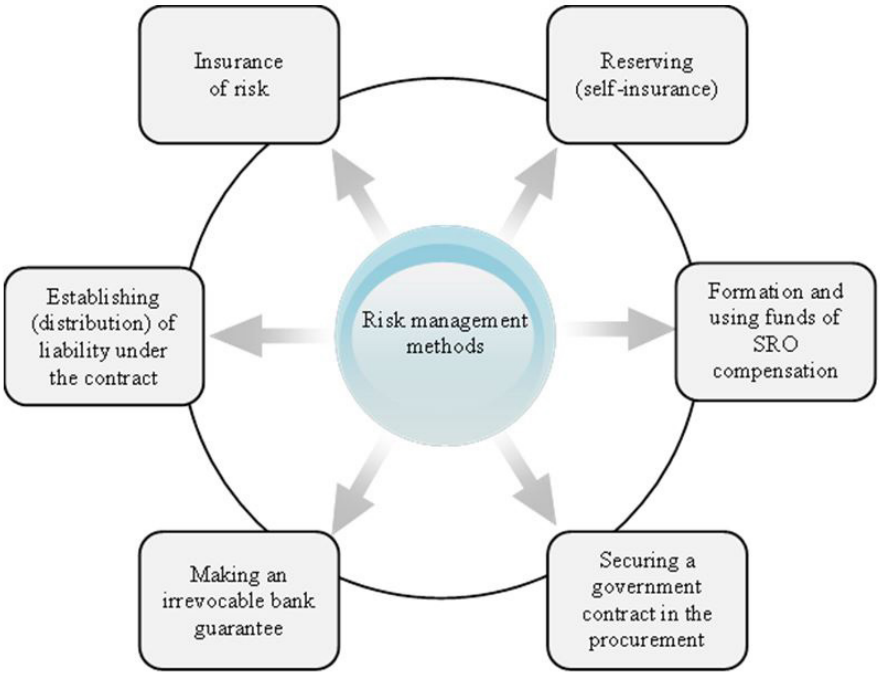

Figure 2. Risk management methods

Modification of the Houston model and its implementation in the problems of optimal risk management of organization are proposed in this paper.

Explicitly, the value of organization C_t at the end of the accounting period can be determined by modeling the costs, results and effects associated with the organization's activities, the implementation of the project or process, with discounting and inflation. Moreover, with any method of ensuring property liability and risk treatment, the value of organization C_t will be:

$$C_t = C_0 - \sum_{i=1}^{t} \alpha_i \varepsilon_i (U_i + Z_i - V_i) + d_a \sum_{i=1}^{t} \alpha_i \varepsilon_i (C_0 - U_i - Z_i + V_i),$$

where C_0 — the value of organization at the beginning of the accounting period without the risk treatment;

i=1,...,t is the simulation step;

α_i — the discount factor at the i-th simulation step; is determined for the constant (E) and variable (E_i) of discount rates, $\alpha_i=(1+E)^{-m}$;

ε_i — the inflation factor; $\varepsilon_i = 1/G_i$, where G_i is the base inflation index;

U_i — the amount of the expected shortfall (damage, losses) of the organization in case of risk materialization at the i-th step;

Z_i — costs associated with the RMS development and implementation, ensuring property liability at the i-th step;

V_i — the amount of the expected compensation for shortfall (damage, losses) in accordance with the accepted method of risk treatment at the i-th step;

d_a — the average yield of free (net) assets of the organization.

An important difference of this approach is the possibility of a cost assessment of risk of harm by indicator R — the cost of risk, taking into account the harm caused in the amount of damage U, costs Z associated with the RMS development and implementation, and possible compensation for damage in the amount of V:

$$R = U + Z - V . \quad (3)$$

Damage will be caused if the amount of actual compensation for damage (loss) is either insufficient for their full compensation or untimely in relation to the costs incurred. Obviously, this condition occurs when $R > 0$.

The functional constraints of the model are the goals and resources of the organization, the conditions and principles for the distribution of responsibility and risk, as well as the conditions for cash flows formation in the considered risk treatment methods.

Using the Houston method in an innovative setting, it becomes possible to justify the choice of the most effective method of risk treatment, as well as the fair distribution of responsibility and risk between subjects of investment activity.

Digital method of distributed risk assessment

The described procedures and the technology for optimal risk management using mixed-integer optimization models of block type for unstructured RMSs with distributed parameters are distinguished by the fact that the search for the optimal solution considers almost unlimited number of possible implementations and consequences of the uncertainty impact on the results and effects compared to the scenario method. In practice, inevitably, this leads to conclusion that the appropriateness and feasibility of applying optimal management methods directly depends on the adequacy and reliability of the distributed risk assessment methods used in the RMS analysis.

For this purpose, the Oparin-Teterin digital method of integral convolution of numerical sequences is used [17, 18], the essence of which is to obtain a discrete risk function according to the accepted indicator of the organization's activity in the form of:

$$R(\hat{E}) = P\{\hat{E}(t) < E^o\}, \qquad t \in [0, T]. \quad (4)$$

The risk function (4) characterizes the probability that the random variable E will be less than the expected value of E^0 on the planning horizon [0, T]. Probabilistically, the risk function is the distribution function of the random variable E of the RMS output parameter, taking into account the uncertainty of the existing risk factors.

As academician A.N. Kolmogorov rightly noted, "... it is reasonable to study real phenomena, avoiding the intermediate stage of their stylization in the vein of representations of mathematics as infinite and continuous, going directly to discrete models" [22].

Explicitly, the discrete risk function is determined by the vector of possible values of the effect $\{E_j\}$ and the numerical sequence $\{r_j\}$, each element of which characterizes the probability that the random variable E will be less than the expected value of E^0:

$$R(\hat{N}_{pv}) = \{r_j\} = \{a_k\}\ \{b_\tau\}, \quad \text{где} \tag{5}$$

$$r_j = \begin{cases} \sum\limits_{\gamma=\max(1,\upsilon)}^{\min(j,\omega)} a_{j-\gamma+1}\, b_\gamma + \sum\limits_{\gamma=1}^{j-s} a_s\, b_\gamma, & \text{если } j > s; \quad (6) \\ \sum\limits_{\gamma=\max(1,\upsilon)}^{\min(j,\omega)} a_{j-\gamma+1}\, b_\gamma, & \text{если } j \le s; \quad (7) \end{cases}$$

$$j = 1,...,n;\ \ n = s + \omega - 1;\ \ \upsilon = j - s + 1.$$

The integral convolution of numbers (5) is applied (z – 1) times for z of random risk factors.

An important condition for the convolution use is the constant duration of the simulation step l_j=const, for which for all j=1, ...,n the following equality is: $E_j + E_{j+1} = E_j - E_{j+1}$.

Compared to Monte Carlo methods, this method does not require intermediate stylization of the benchmark statistics and a priori information about the desired distributions, and the necessary reliability of the assessments obtained both at the level of average values and at the tails of distributions can be achieved with a relatively small number of implementations ($10^2 - 10^3$).

The main advantage of the method of integral convolution of numbers is the ability to obtain a distributed risk assessment without and taking into account the integrated risk treatment, with set structure and known parameters of the integrated risk management system.

Conclusions

The results of research lead to the following conclusions.

The modern stage of risk management development is marked by discrepancy between the implemented risk management systems and the real risk situation, the current factors and the degree of their impact on the goals, results and effectiveness of organizations, which is due to insufficient reliability of standardized risk management procedures and economic decisions made on their basis for practical purposes.

The optimal risk management concept and the technology for implementing it discussed in this paper are directly oriented to determining the optimal or best, with regard to accepted efficiency criterion, risk treatment methods, optimal structure and parameters of RMS taking into account the uncertainty and randomness of the existing risk factors.

Using technology of structural and parametric optimization and mixed-integer optimization models of block type for practical purposes the development and implementation of RMS can lead to a significant, on average, 50-60%, increase in the RMS effectiveness.

The new digital risk management paradigm is logical, reflects the result of modern digital technologies introduction in risk management practice, provides for the rejection of the hypothesis about the normal distribution of the output parameters of the ecosystem under study, and the preservation of the required information content of the "digit" in the context of process approach.

Directions for further research

The use of digital technologies and optimal risk management methods using structural and parametric optimization procedures and mixed-integer optimization models of block type ensures the reliability of economic decisions that are extremely important for practical purposes and provides new opportunities for effective management in the digital economy.

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DIGITAL PLATFORMS FOR DEVELOPMENT OF INNOVATIVE TRANSPORT LOGISTIC SYSTEMS

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The article is devoted to the analysis and solution of a problem of innovative transport and logistics system on a digital platform. The research topic is relevant due to the urgent need for a new, innovative approach to creating a transport and logistics system based on modern digital technologies. The authors formulate the provisions of a conceptual approach to the creation of a common digital platform characterized by the use of the integrated logistics paradigm as the basic concept of managing the interaction of market entities in the supply chain "supplier-transport company-consumer". It serves as the basis for the introduction of telematics principles in the operational management of the transport and logistics system. We consider recommendations on the creation of joint digital platform for participants of the transport and logistics system in the context of focus on solving the problems of operational impact on the flow of goods, increasing the speed and quality of customer service. We consider the concept of "innovative transport and logistics system" and define the role of digitalization in the process of creating a transport and logistics system. To increase the efficiency of the management process of the transport and logistics system of an innovative nature on the basis of the process approach the stages of its formation have been developed. For each of the stages the authors propose to apply information technologies determined by the nature of its results. The experience of the development and implementation of innovative products in transport logistics is analyzed, the existing shortcomings are revealed, in particular, related to satellite tracking systems, the influence of the human factor on the results of operations, poor attention to the development of innovations in the transport and logistics system for the integration of warehouse and transport facilities. We conclude that while many technologies, systems and programs that allow you to track and determine the location of both the vehicle and the cargo separately are in operation, the formation of innovative transport and logistics system on a digital platform remains relevant and unresolved. When developing and implementing the stages of forming an innovative transport and logistics system, certain prerequisites should be taken into account, including organizational ones (analysis of processes and functions performed by subjects of transport and logistic interaction, creation of a regulatory legal field, development and approval of technological standards and information exchange protocols); technological (ensuring efficient online interaction during logistics operations, implementation of support for users of the CDP in the remote access mode with transaction partners; implementation of technological interfaces to systems containing transport and logistics information).

Keywords: innovative transport and logistics system, digital platform, information technology, analysis

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ФОРМИРОВАНИЕ ИННОВАЦИОННОЙ ТРАНСПОРТНО-ЛОГИСТИЧЕСКОЙ СИСТЕМЫ НА ЦИФРОВОЙ ПЛАТФОРМЕ

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Статья посвящена анализу и решению проблемы формирования инновационной транспортно-логистической системы на цифровой платформе. Актуальность темы исследования определяется настоятельной необходимостью нового, инновационного подхода к проектированию и созданию транспортно-логистической системы, базирующейся на современных цифровых технологиях. Сформированы положения концептуального подхода к созданию общей цифровой платформы, отличающейся применением интегральной парадигмы логистики как базового понятия управления взаимодействием субъектов рынка в цепочке поставок «поставщик-транспортная компания-потребитель», что служит основой для внедрения принципов телематики в оперативном управлении транспортно-логистической системой. Рекомендации по созданию совместной цифровой платформы участников транспортно-логистической системы рассмотрены в контексте направленности на решение задач оперативного воздействия на товаропоток, повышение скорости и качества обслуживания клиентов. Рассмотрено понятие «инновационная транспортно-логистическая система», определена роль цифровизации в процессе создания транспортно-логистической системы. Для повышения эффективности процесса управления транспортно-логистической системой инновационного характера на основе процессного подхода разработаны этапы ее формирования. Для каждого из этапов предложены определенные характером его результатов информационные технологии. Проанализирован опыт разработки и внедрения инновационных продуктов в транспортной логистике, выявлены существующие недостатки, в частности, относящиеся к системам спутникового слежения, влиянию человеческого фактора на результаты деятельности, слабому вниманию при разработке инноваций в транспортно-логистической системе интеграции складского и транспортного хозяйства. Сделан вывод о том, что при действующих на практике множестве технологий, систем, программ, позволяющих отслеживать и определять место нахождения как транспортного средства, так и груза в отдельности, остается актуальным и нерешенным вопрос формирования инновационной транспортно-логистической системы на цифровой основе. При разработке и реализации этапов формирования инновационной транспортно-логистической системы следует учитывать определенные предпосылки, в том числе организационные (анализ процессов и функций, исполняемых субъектами транспортно-логистического взаимодействия, создание нормативного правового поля, разработка и утверждение технологических стандартов и протоколов обмена информацией); технологические (обеспечение эффективного, оперативного онлайн взаимодействия в процессе выполнения логистических операций, реализация поддержки работы пользователей ОЦП в режиме удаленного доступа с партнерами по сделкам; реализация технологических интерфейсов к системам, содержащим транспортно-логистическую информацию).

Ключевые слова: инновационная транспортно-логистическая система, цифровая платформа, информационная технология, анализ

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Introduction

In modern world there is a need to provide quality transport and logistics services in conditions of intense competition, the integration of market entities in the international economic space. In the furtherance of this goal, digitally enabled innovations are a key to success, since innovative activities foster a generation of new ideas introduced into management processes and industries, and creation of new technologies. Experience has shown that introducing innovations into transportation logistics companies can result in the cost, time and energy efficiency, and therefore, satisfy the consumer needs. Application of innovative and digital technologies gives a company distinct competitive advantages, and take the lead in a particular field for years to come. According to estimates by the UNESCO Institute for Statistics (data for December 2018), $ 1.7 trillion was spent on innovation in the world in 2017 according to purchasing power parity, 47% of expenses on innovation in the world are in the USA and China, 80% in the top ten countries.

Logistics is one of the most digitalized industries, both in the world and in Russia [27], which is reflected in foreign sources studying logistics [1–6]. Most of the new trends in the logistics industry are impossible without innovations in the development of digital technologies in logistics. At the same time the use of modern digital technologies in logistics is a target factor in increasing the country's economic competitiveness [13].

The calculations of experts from the Higher School of Economics Institute for Statistical Studies and Economics of Knowledge showed the following: the highest share of innovative goods in the service sector is 14.5%, the share of costs in this sector invested in innovation amounts to 2.3% of the total volume of products sold; in the industry this indicator is 6.7% (costs per unit at 1.7%). Investments in R&D and innovation make up from 2 to 7% (in total costs, according to *Vedomosti&* surveys for large companies).

Digitization strategy of the logistics system is claimed to be a trending topic in the Decree of the President of the Russian Federation "On National Goals and Strategic Tasks of the Development of the Russian Federation for the Period until 2024". At the digital forum in Almaty in February 2020, the prime ministers of the EAEU (Eurasian Economic Union) countries focused on how digitalization helps to develop the economy and social sphere. The discussion at the forum focused on such topics as artificial intelligence, electronic document management and cloud technologies[1]. The proportion of organizations which make technological investments is presented in Fig. 1.

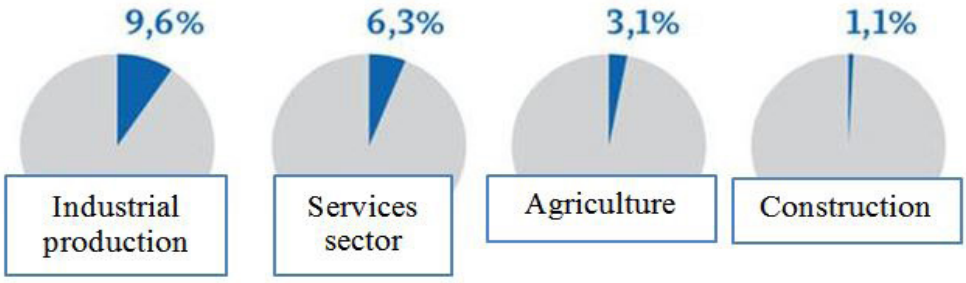

Figure 1. Proportion of technological investment organizations
(Source: HSE Institute for Statistical Studies) [16]

The digitalization of Moscow transport is evidence of the effectiveness of the topic under discussion. It is based on the use of big data analysis, machine learning and the introduction of the most advanced technologies. The territory of the city is covered by the Intelligent Transport System, supplemented by the Situational Centre for Road Traffic Organization[2].

The Transport Strategy of the Russian Federation for the Period until 2030 was amended and restated, and adopted by the RF Government in June 2014. The strategy set out to design motivation mechanisms taking advantage of innovative logistics technologies to be utilized to upgrade the freight rolling stock. Modern information and telecommunication technologies, telematics, and the global navigation system GLONASS are the instruments for introducing into practice and intellectualizing transport and logistics systems and integrating all participants in the supply chains of goods. The target of the Industry 4.0 concept is the accelerated integration of cyber-physical systems into factory processes as a result of which a significant part of the production will take place without human participation. Industry 4.0 is associated with concepts such as Industrial Internet of Things, Digital Enterprise of a new technological structure based on large-scale innovations. The ability to innovate is becoming a new factor in the development of transport and logistics infrastructure and an effective way to overcome crisis trends in the context of global competition [12].

[1] CIS: the space of integration. URL: https://e-cis.info/news/567/85456/ (accessed March 5, 2020).
[2] SCRTO official site. URL: https://roads.mos.ru/ (accessed March 6, 2020).

Germany is the leader in the development of Industry 4.0, where Intelligent Technical Systems OstWestfalenLippe is the answer to the Silicon Valley. Similar programs have been launched in the Netherlands, France, Great Britain, Italy, Belgium, etc. In the United States since 2012, there is a non-profit "Coalition of Leaders of Smart Manufacturing" combining business, universities and government agencies, which confirms the leadership of the country in terms of expenditures connected with innovations (Fig. 2).

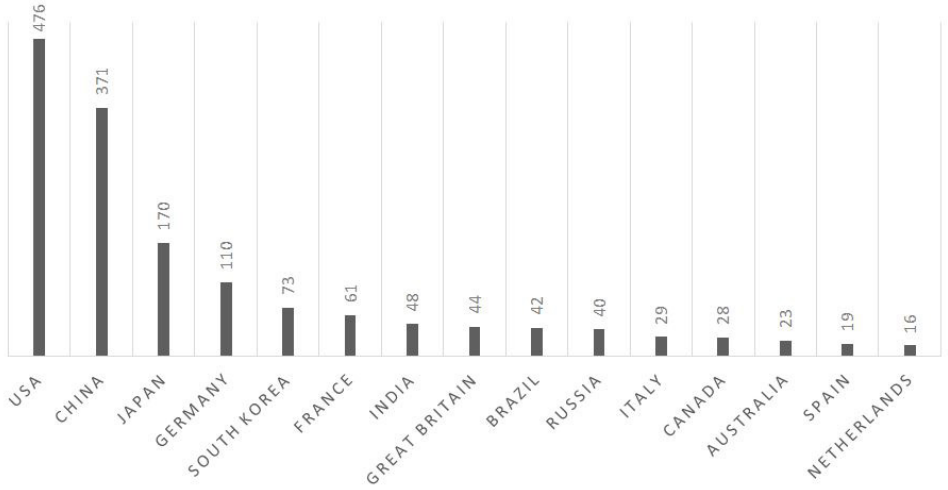

Figure 2. Costs of innovation by country, $ billion
(Source: UNESCO Institute of Statistics) [32]

Digital economy is a future stage in the development of the global economy due to the transformation of all spheres of human activity under the influence of information and telecommunication technologies [10]. In relation to the problem under consideration, it is important to focus on the following definition: "Digital economy in transport can be interpreted as an IT platform for the tasks of innovative, balanced development and efficient use of a single transport infrastructure" [7]. A digital economy is a display of all data in digital form. The navigation in the indicators and records that are compiled in organizations is fast, and the search for a certain piece of information, statistical indicators, etc., in digital form is simple [8]. In a narrow sense, a digital economy is understood as a combination of online platforms, as well as the types of activity possible thanks to such platforms. In a broad sense, the digital economy refers to all types of activity based on the use of digital data[3].

In the framework of the study, the definition of the International Monetary Fund is more relevant, since it reflects the role and importance of digital platforms in the formation of innovative transport and logistics systems in relation to the current situation. This serves as the basis for supporting real-time goods distribution processes and allows to make decisions in real-time in case of failures within the transport and logistics system.

Information logistic systems become important to ensure well-coordinated logistic work, since the functioning of the entire logistic system as a whole depends on their work [22].

Having analyzed the experience in the development and implementation of innovative products in transport logistics, note that in the existing systems considered there are a number of drawbacks, summarizing which we come to the following conclusion:

– satellite tracking systems have the so-called "blind spots" in which observation is impossible;

– the human factor, both the user of the product and the driver of the vehicle affect the results of the activity;

[3] International Monetary Fund. URL: https://www.imf.org/external/russian/index.htm (accessed March 10, 2020).

– insufficient attention is paid to the development of innovations in the transport and logistics system for the integration of warehouse and transport facilities;

– insufficient account of the customs clearance and other operations, necessary when transporting goods.

The elimination of these shortcomings in transport and logistics is inextricably linked with information technologies, which affects all spheres of society. Their use in practice allows the most efficient processing of existing data, use of existing knowledge for timely adoption and implementation of management decisions [9].

Thus, today the management of the efficiency of performing other functions that facilitate the process of delivery of goods to the customer did not provide an active area for the introduction of innovative technologies. Although there are many technologies, systems, programs that allow you to track and determine the location of both the vehicle and the cargo separately. The fact that freight transportation has not been integrated into a supply chain using a single digital platform is one of the challenges of transportation logistics. The creation of a single platform makes it possible to save money and optimize the delivery of goods from China, as one of the priority areas of the transport industry in Russia.

The company's programmers develop and modify their systems annually. The lack of a single digital platform for the transport industry of the Russian Federation holds back the rapidly developing transport and logistics area at the moment. It is a favorable area for implementing an innovative approach to the process of forming a model of a transport and logistics system for servicing a certain circle of customers on a common digital platform.

The purpose of this article is to develop the stages of the formation of an innovative transport and logistics system on a digital platform, focused on stimulating the effective use of the components of an innovative transport and logistics system to implement the tools of the digital economy.

The objective of the article is to submit the suggestions relating the concept of a digital platform in the transport and logistics system, determine the role of innovation in the digitalization process, study the prerequisites, goals, tasks of creating a common digital platform of the transport and logistics system for customer service, develop the relationship of information technologies and recommendations for the formation of innovative transport and logistics systems to improve the quality of customer service with transport and logistics services.

The research methodology includes analysis and systematization of domestic and foreign developments on the organization of the process of formation of an innovative transport and logistics system on a digital platform that ensures the interaction of participants in the supply chain in order to improve the quality of customer service and goods flows.

The main purpose of the process of forming a model of an innovative transport and logistics system is to obtain an efficiently functioning supply chain that guarantees a stable supply of enterprises with material and technical resources, consistent demand for finished products and its positive work as a whole, implemented using this model. For the interaction of any enterprise with the external environment in modern market conditions, optimization of the movement of material flows of great importance [26].

However, the improvement of technological processes, including innovative activities as one of the most relevant methods for the development of transport logistics, in Russia is much slower than in Western Europe and the United States. The reason is focusing on optimizing warehouse logistics. At the same time, the demand for transport services based on modern information technologies and telecommunication systems, which allows optimizing the sequence of operations in the entire supply chain. A prerequisite for this is a flexible functioning of the transport and logistics system, capable of perceiving innovative achievements on the basis of a single digital space. Being a direct factor of production, the information requires ensuring security as a condition of economic security, data preservation, reliability, relevance, value, completeness, reliability and secrecy [24].

Creating a single logistics space based on digitalization can facilitate delivery processes anywhere in the country. Such space is a set of integrated systems, including platforms for transport planning using

various modes of transport and infrastructure. The general level of digitalization of market participants in the Russian Federation does not allow creating a single digital space.

Nevertheless, a variety of modern digital technologies used in various fields of human activity, proves their necessity in solving a number of applied problems, in particular, in logistics and supply chain management [11]. The Ministry of Transport is engaged in the preparation of a digital platform for the entire transport complex of the country. The company A + C Transproject, involved in the development of a mathematical model of the country's transport flows, engages transport planning based on a three-level system: city, region and country. It is assumed that the region uses data from cities, and the country uses data from regions. All the data will be included into a unified system. As a result, modern services do not allow the integration of participants in the complete supply chain. The position cannot be realized according to which in modern conditions the competitiveness and effectiveness of the organization, industry, the country is largely determined by the logistics component [16].

Today the society has realized that the constant and growing demand for mobility in the world cannot be met by the simple expansion of modern vehicles. Although transport is essential for modern civilization. Actually, transportation systems are a key source of traffic bottlenecks, roadway accidents, climate change, and resource depletion, public health problems due to air pollution and noise, and ecosystem degradation. The use of global navigation satellite systems and satellite communications can increasingly contribute to solving mobility problems through innovative services. Due to GNSS the ability to accurately determine and report your position at any time begins to have a significant impact on managing a fleet of trucks, monitoring road and rail traffic, mobilizing emergency services, and tracking goods transported by multimodal vehicles, transport and air traffic control.

Well-designed transportation and logistics systems are fundamental to individual mobility, trade, wealth, and economic growth. In connection with the constantly growing volumes of transportation and cargo, emerging transportation systems will face tough challenges related with how to balance the need for fast, efficient and sustainable transport with negative consequences. The answer is in a closer integration of telecommunications and information technology. Autonomous driving has already become a reality, vehicles are connected with each other and with the infrastructure in smart cities. It allows to collect all kinds of data for use in the decision-making process. Digital technologies confidently move from the category of auxiliary equipment to the main class. They allow to reduce the cost of management and communication in the organization and implementation of transportation, improve the quality of transport and logistics services, etc. [19].

The digital supply chain consists of the following key elements: integrated planning and execution, logistics transparency, intelligent warehousing, efficient spare parts management, autonomous logistics and B2C logistics, an analytical supply chain, and digital supply chain tools. Companies that can combine these parts into a single and completely transparent system can receive huge advantages in customer service, flexibility, efficiency and lower costs. Those that delay the changes will fall further and further behind. How these elements work to provide a digital supply chain is the subject of this study.

Behind the enormous potential of the digital supply chain (DSC) lies "Industry 4.0", the fourth industrial revolution. The transformation in production and automation was caused first by steam and water energy (Industry 1.0), then by electrification (2.0) and by a digital computer (3.0). Industry 4.0, digitalization, is a customer-oriented campaign through e-commerce, digital marketing, social networking and customer interaction. All aspects of the business will be transformed through the vertical integration of research and development, production, marketing and sales, and other internal operations and new business models. These models are based on these achievements. In fact, we are developing towards a complete digital ecosystem. Digital transformation dictates the need for fundamental changes in approaches to business, affecting absolutely all its aspects. The transformation is based on the idea of continuous business modernization and improvement [14].

The establishment of information support is one of the main tasks of any company which engaged in the transport of goods. In logistics, with the advent of GPS, GSM, WI-FI and other wireless methods of transmitting information, it becomes possible to solve a big problem: currently you can keep track of the condition and location of the cargo online, which allows to respond to difficulties more quickly and make decisions. In the future, innovations will affect the management system for the maintenance and the rolling stock. In particular, if a malfunction occurs, its code will be automatically transferred to the office to the mechanics. Those can send recommendations on how to fix it on the driver's smartphone. All diagnostic data can be obtained not upon car's arrival, but also while it's still in operation.

The information and technology revolution, leading to the formation of a new technological structure, sets a new direction for the development of the national economy and innovative technological solutions to improve quality of artificial intelligence systems, global information networks, robotics, unmanned vehicles, electronic commerce, big data processing technologies, and high-tech products. The development of the digital economy in the Russian Federation takes into account and complements the goals of the National Technology Initiative [28].

In order to implement the Industry 4.0 concept, most corporate processes must become digital. A critical element will be the evolution of traditional supply chains towards a connected, smart and highly efficient supply chain ecosystem. The supply chain today is a series of largely discrete, disparate steps through marketing, product development, production and distribution. Digitization destroys these walls, and the chain becomes a fully integrated ecosystem that is completely transparent to all players involved: from suppliers of raw materials, components and spare parts to carriers of these materials, and finished products to customers.

This network will depend on a number of key technologies: integrated planning and execution systems, logistics' transparency, autonomous logistics, smart procurement and warehousing, spare parts management and advanced analytics. The result will allow companies to respond to supply chain failures and even anticipate them by fully simulating the network, creating "what if" scenarios and adjusting the supply chain in real-time when conditions change.

Consider how the supply chain ecosystem works. An important point in the development of the digital economy is the strengthening of consumer confidence in it. This is facilitated by an increase in the availability, integrity, confidentiality, and authenticity of online transactions [15].

At most companies, products are delivered to customers through a very standardized process. Marketing analyzes customer demand and tries to generate information to predict sales for the coming period. Related to this information are orders for the production of raw materials, components and parts for the expected capacities. The distribution takes into account upcoming changes in the number of products entering the supply chain. The customers are informed when to expect shipments. If everything is going well, the gap between supply and demand at each point in the system is small. This rarely happens because forecasting remains an inaccurate science. The data on which it depends can be conflicting and incomplete.

Too often, production operates independently of marketing, customers, suppliers and other partners. Lack of transparency means that none of the links in the supply chain understands what any other link does or needs. It seems inevitable that at some point the streamlined flow from marketing to the client is disturbed. To avoid this, the digital economy should require employees to constantly develop competencies to achieve their goals, the competent use of skills, knowledge and abilities in professional activities and be a worthy competitor in the labor market [23].

Based on the foregoing, we consider it expedient and necessary in the process of creating an innovative transport and logistics system to implement the integrity principle formulated by the authors in addition to the existing ones (principles of a systematic approach; taking into account the total logistics costs within complex logistics production, transport and transportation systems; coordination and integration; global optimization, etc.). Under the principle of integrity, the authors understand that the formation

of a transport and logistics system should be designed so that during its operation the changes made do not violate its integrity, and it continues to operate as a packaged, well-oiled system designed to realize a common task of adjusting to market conditions, a specific environment, while improving the quality of services and reducing all types of costs.

The results obtained and their discussion

When creating innovative transport and logistics systems, it is proposed to follow step-by-step recommendations on organizing the process of forming an innovative transport and logistics system based on a common digital platform (CGP). The stages are considered by the authors as the basis for creating an innovative transport and logistics system based on modern digital technologies.

When developing and implementing the stages of forming an innovative transport and logistics system, certain prerequisites should be taken into account.

Organizational tasks:

– analysis of processes and functions performed by subjects of transport and logistics interaction, as well as the creation of a regulatory legal field;

– development of a roadmap for amending the regulatory framework for transforming existing processes or introducing new ones;

– development and approval of technological standards and information exchange protocols that provided seamless integration of systems.

Technological tasks:

– creation of a single-entry point for digital platforms in the field of innovative transport and logistics interactions in the supply chain;

– ensuring efficient online technical interaction (including in the process of performing logistics operations) of supply chain participants by the goals and objectives of the transport and logistics cycle;

– implementation of support for the operation of users of CGPs in remote access mode, including with foreign partners in transactions;

– support for the effective exchange of transport and logistics information between participants in the supply chain;

– providing participants with the common standards required for joint innovative research in the field of transport and logistics with access to external distributed systems for storing and processing the necessary information;

– ensuring integration with external information systems, including foreign systems for identifying participants in supply chains and their interaction;

– ensuring the management of mutual settlements for transport and logistics operations, the joint use of infrastructure when researching the field of transport and logistics between the participants of the digital platform;

– implementation of technological interfaces to systems containing transport and logistics information;

– implementation of technological interfaces for interacting with digital platforms of participants in supply chains and leading logistics centers;

– implementation of technological interfaces for interaction with participants in the supply chain.

Recommendations on the organization of the process of forming an innovative transport and logistics system will be presented as a phased process characterized by certain activities (Fig. 3):

The first stage. Determining the grounds for the development of CGP, as such grounds are:

– Decree of the President of the Russian Federation No. 642 of December 1, 2016 "On the strategy of scientific and technological development of the Russian Federation".

– The state program "Scientific and technological development of the Russian Federation", approved by the decree of the Government of the Russian Federation of March 29, 2019. No. 377, main activity 4.4. "Development of digital platforms for participants in scientific and technological development".

– Transport strategy of the Russian Federation for the period until 2030.

– Decree of the Government of the Russian Federation of March 29, 2019 No. 377 "On approval of the state program of the Russian Federation "Scientific and technological development of the Russian Federation".

– The decree "On national goals and strategic objectives of the development of the Russian Federation for the period until 2024".

– Order of December 29, 2017 No. 887 "On the Approval of Methodological Provisions on Transport Statistics".

The second stage. Determining the goal and objectives.

The goal is to develop recommendations for a phased process of forming an innovative transport and logistics system for its implementation on a digital platform. Tasks:

– to develop the stages of the formation of an innovative transport and logistics system on a digital platform;

– to formulate a goal, tasks, principles of forming a common digital platform for the interaction of elements of an innovative transport and logistics system;

– determine the organizational and technological prerequisites for creating a common digital platform for an innovative transport and logistics system with information support through the use of GPS, GSM, WI-FI and other wireless methods of transmitting information.

Transport logistics is a favorable area for the emergence of new innovative technologies. Transport logistics is multimodal and requires an approach based on an integrated transport policy [17]. Examples of digital technologies: Gonrand, Videotrans, STS, BRS, Espace Cat, ISCIS, etc.

The fourth stage. Formulation of the basic principles for the creation and operation of a common digital platform of the transport and logistics system (CGP).

The main principles include the following:

– centralization of information on the interaction of participants in the supply chain;

– the presence of well-established schemes for collecting information about customers and the structure of the material flow;

– completeness and availability of information on the interaction of counterparties on transactions;

– the active use of information technology and computers;

– a clear division of powers between decision-makers;

– the presence of partnerships of participants in the supply chain;

– the availability of a competent legal service.

The implementation of these principles on the basis of the introduction of digital technologies will increase the efficiency of interaction between participants in the transportation process, create organizational and technological conditions not only for concluding smart contracts for multimodal transportation, but also for automating the processes of controlling the movement of vehicles and cargo operations in transport hubs, paperwork and settlements with all participants in the supply chain [18].

The fifth stage. Defining the boundaries and functions of the system.

The boundaries of the innovative transport and logistics system are determined by:

– the deployment of suppliers, consumers, cargo, transport companies serving this supply chain (physical boundaries);

– served by this transport and logistics system with the required services of regional, interregional and other customer markets (economic borders).

Functions:

– implementation of basic platform services, as well as applied digital services for platform interaction within the framework of an innovative transport and logistics system, including services aimed at digital support of counterparties for transactions in the supply chain, growth in the volume of transport and logistics services;

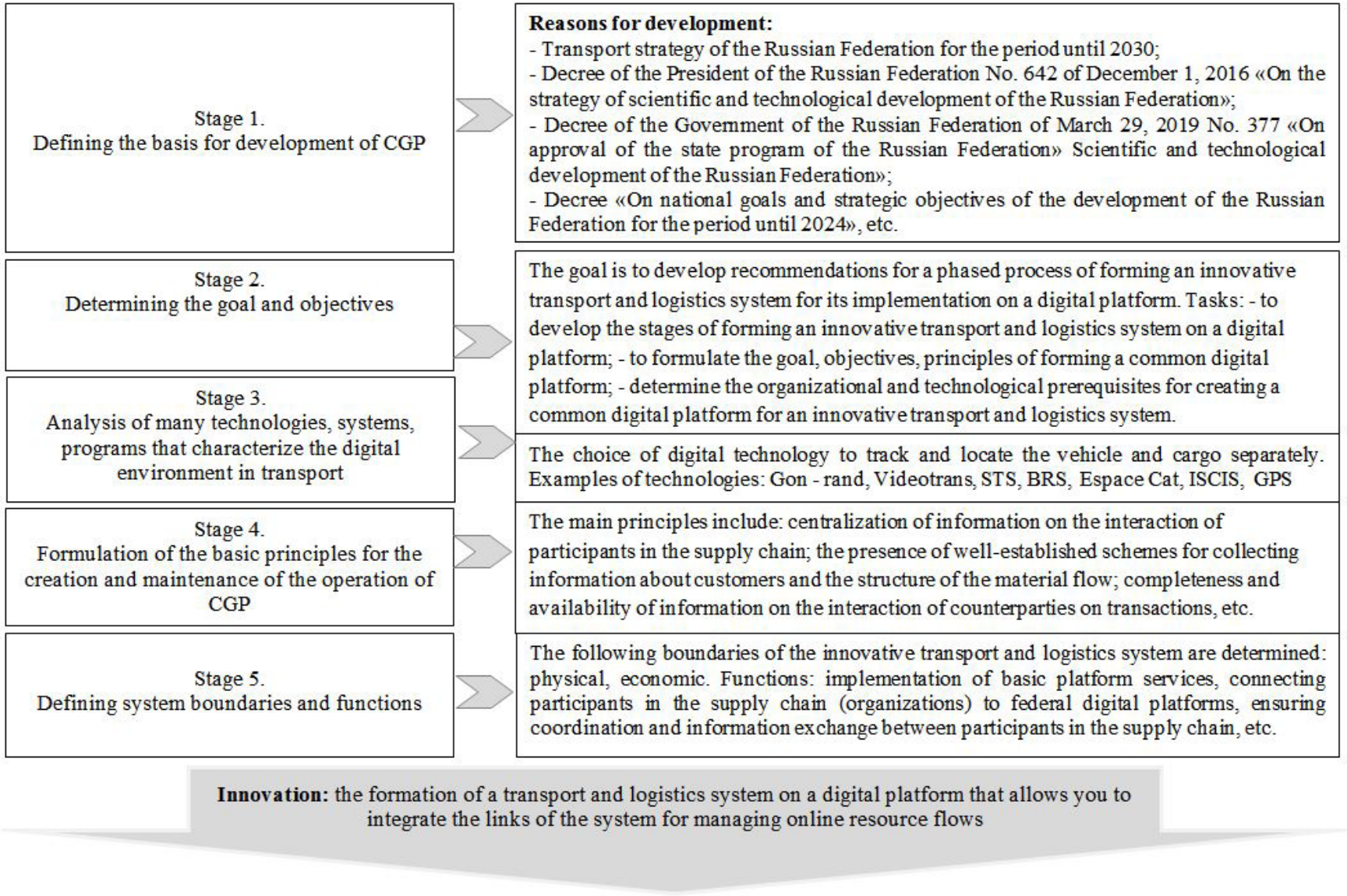

Figure 3. Stages of the innovative transport and logistics system formation on a digital platform

– connecting participants in the supply chain (organizations) to federal digital platforms (information systems and resources) between which information interaction is provided to carry out intra-regional and inter-regional transport and logistics activities under the concluded agreements;

– ensuring coordination and information exchange between participants in the supply chain, including through the conclusion of agreements on information interaction.

The creation of a single information system allows the formation, management and control of the supply, production, transport, storage facilities, distribution system for the successful functioning of the enterprise as a whole [21]. The process of introducing digital technologies into the activities of transport organizations not only helps to increase their competitiveness, but also leads to the digitalization of the country's economy as a whole [20].

Thus, the study reflects the following results. The authors:

1. Developed the stages of the formation of an innovative transport and logistics system on a digital platform, characterized by specific actions aimed at ensuring effective, efficient and technical interaction regarding the logistics operations of supply chain participants, which allows for a clear structuring of the process of creating such a system.

2. Formulated the goals, objectives, principles of the formation of a common digital platform for the interaction of elements of an innovative transport and logistics system, characterized by a focus on integration with external participants of the supply chain for this system based on a single operational management system for decision-making control in the online response to problems in goods distribution.

3. Identified the organizational and technological prerequisites that are necessary, on the one hand, for creating innovative transport and logistics systems supported by digital technologies, on the other hand, for organizational support for the effective exchange of transport and logistics information between participants in the supply chain, as in the process of forming the system, and its effective functioning.

Conclusion

The implementation of the proposed phased recommendations on the formation of an innovative transport and logistics system on a digital platform allows:

– to formulate general principles and general logic of constructing such a system within the framework of which it is possible to establish information support for operational monitoring and evaluation of the implementation of the goals and objectives of the entire supply chain using innovative wireless methods of transmitting information;

– to prove the innovativeness of the implementation of the main research idea: logistics is the impetus in the digital economy, which creates intellectual mobility as a new industry combining the movement with finances, physical objects and human flows, and thus, requiring serious changes for future supply chains [25];

– to provide, on the basis of common digital standards, the participants of joint innovative research in the field of transport and logistics with an access to external distributed systems for storing and processing the necessary information, as conditions for the practical use of the proposed step-by-step process of forming an innovative transport and logistics system.

Directions for further research

The presented research results and recommendations are to be further discussed, since the process of forming an innovative transport and logistics system can be varied both in terms of target settings, depending on the industry context, and the implementation of technological interfaces for interacting with digital platforms of participants supply chains and leading logistics centers. Further developments may be related to the study of the features of the implementation of technological interfaces for interaction with participants in the supply chain, as well as the analysis of processes and functions performed by subjects of transport and logistics interaction. In addition, a study of the issues of managing financial flows of mutual

settlements for transport and logistics operations is of interest, sharing infrastructure when conducting research in the field of transport and logistics between the participants of the digital platform.

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TERRITORIES WITH A SPECIAL LEGAL REGIME OF ECONOMIC ACTIVITY AS AN INSTRUMENT OF REGIONAL INNOVATIVE POLICY

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One of the instruments of the regional policy is the establishment of special legal regimes of economic activity within the boundaries of a certain territory aimed at solving various tasks. Such tasks include accelerating and integrating economic processes, attracting investments, developing territories, production, and innovative activities, as well as aligning the socio-economic development of the constituent entities of the Russian Federation. The authors focus on the essence of such an instrument of regional policy as special legal regimes of economic activity established within the boundaries of a territory. The authors' methods of research included analysis, generalization, systematization, comparison, interpretation, juxtaposition. The authors analysed basic existing forms of spatial organization of innovative economy, administrative and legal regimes, specified the definitions of the reviewed forms, the requirements and potential scale of an organization, composition of participants, availability of investments, essence of governmental participation and regulation, existing measures of support, procedures of creation and termination, terms of functioning and etc. The authors conclude the instrument under consideration is overly widespread and territorial zoning is used excessively, while often falling short of high expectations and providing no sufficient economic effect. The conclusions made by the authors may help with further studies on integration processes in innovative environment, to determine ways, forms and methods of perspective development of the innovative infrastructure in the future.

Keywords: regional economy, territorial zoning, special legal regimes, innovations

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ТЕРРИТОРИИ С ОСОБЫМ ПРАВОВЫМ РЕЖИМОМ ВЕДЕНИЯ ЭКОНОМИЧЕСКОЙ ДЕЯТЕЛЬНОСТИ КАК ИНСТРУМЕНТ РЕГИОНАЛЬНОЙ ИННОВАЦИОННОЙ ПОЛИТИКИ

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Одним из инструментов региональной политики является установление в границах определенной территории особых режимов хозяйственной деятельности, направленных на решение различных задач ускорения и интеграции экономических процессов, привлечения инвестиций, развития территорий, производства, инновационной деятельности, а также выравнивания социально-экономического развития субъектов Российской Федерации. Авторами проведено исследование с целью наиболее полного определения сущности территорий с установленным специальным правовым режимом ведения экономической деятельности как инструмента региональной политики. Проанализированы основные существующие формы пространственной организации инновационной экономики,

административно-правовые режимы функционирования, уточнены дефиниции рассмотренных форм, требования к организации и ее возможный масштаб, состав участников, наличие инвестиционной составляющей, сущность государственного участия и регулирования, существующие меры поддержки, порядки создания и прекращения, сроки функционирования и др. Сделаны выводы о чрезмерном распространении особых правовых режимов, массовом характере зонообразования наряду с завышенными ожиданиями от их создания и недостаточными практическими результатами их функционирования. Полученные выводы могут использоваться в дальнейших исследованиях в области интеграционных процессов в инновационной среде, определении направлений, форм и способов перспективного развития инновационной инфраструктуры.

Ключевые слова: региональная экономика, территориальное зонирование, особые правовые режимы, инновации

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Introduction

The innovative system creates favourable conditions for the development of the economy, increasing competitiveness of enterprises, the interaction of its participants provides innovative development of the regions as well. In the context of modern integration in order to develop innovative systems, there is a need to find effective ways of functioning [1].

One of the instruments of regional policy is the establishment of special legal regimes of economic activity within the boundaries of a certain territory aimed at solving various tasks. Such tasks include accelerating and integrating economic processes, attracting investments, developing territories, production, and innovative activities, as well as aligning the socio-economic development of the constituent entities of the Russian Federation.

A legal regime is defined as «a regulatory procedure manifested in a set of legal means characterizing a special combination of interacting permissions, prohibitions, as well as positive obligations and creating a special focus of regulation» [2].

Currently, in the legal and economic spaces, the following basic legal regimes have been established for organizing economic activities within the boundaries of a certain territory: zones of territorial development; special economic zones; clusters; innovation and industrial parks; technopolises; territories of advanced social and economic development; free ports; technopoles (naukograds); international transport corridors.

In addition, various kinds of innovative infrastructure play a significant role in the commercialization of innovations and the national innovation economic system. In particular, technology parks and business incubators [3] with a functioning mode defined as special due to peculiarities of creation, functioning organization and termination.

All these forms of spatial organization of the innovative regional economy are characterized by a special legal regime for economic activity on their territory, have a special procedure of creation, functioning, management and termination. They are aimed at solving the problems of economic growth and regional development.

Today, competitiveness of a region economy depends not only on the innovations themselves, but also on organizational changes that contribute to high commercial results, as well as market promotion and adoption of these innovations, which often justifies various kinds of innovative territorial formations and clusters [4].

Researchers consider regional innovation territories as a part of an integrated mechanism and tool for managing regional development. The effectiveness of a cluster or any other form of organization of an innovative economy is directly related to the objectives of regional development in the economic, social and environmental spheres [5, 6].

Some researchers understand territorial entities with a special mode of functioning of entrepreneurial activity as "growth points" formed by the state purposefully when implementing a policy of the so-called focused development. This policy is in contrast to the policy of socio-economic equalizing of the territories [7]. Other scholars associate the emergence and development of the special regime territories with the arising need for a competitive advantage of territories and the struggle for resources [8]. Certain legal regimes are often considered an effective tool for the international innovation development as well [9, 10].

Special legal regimes also emerge and develop on the basis of the theory of productive forces distribution in the region [11]

Any administrative and legal regime outlines relations between entities, various guarantees (legal, material, technical, organizational, economic, etc.), as well as criteria of responsibility, and control and management mechanisms.

In addition, territories with a special regime attempt to ensure the balance of private and public interests of the participants using administrative and legal means [12].

It is noted that the use of special legal regimes of economic activity in recent years has become one of the priority areas of spatial regional development. Nevertheless, a number of errors in the creation and development of the selected mechanisms did not lead to the expected results [13]. These tools became an end in itself, while they were supposed to be only a means to solving the problems of regional economic development [14].

Excessive distribution of special legal regimes, massive nature of zone formation, expansion of the opportunities to use special regimes by almost all regions have led to a shortage of a sufficient number of residents, "transfer" of previously prepared and implemented investment projects to the borders of the formed zones, lack of funding, lag in infrastructure construction, tax revenue losses of budgets and other problems [14].

The existing methods and criteria for selecting territories to create a particular zone, as well as the criteria for assessing the effectiveness of functioning territorial entities raise many questions [15, 16].

Foreign researchers also focus on the study of successful industry-specific cluster ideas and concepts as a tool for formation and development of a regional economy [17], develop econometric models for cluster analysis based on systematization of cluster formations and identification of cluster characteristics that provide regional growth [18].

Audit, effectiveness evaluation, and timely introduction of changes to the regional policy in effect require understanding the essence of special legal regimes, their features and characteristics.

Given the above, the authors consider a very relevant topic. Scientific literature presents studies on certain legal regimes, the predominant amount of research is devoted to clusters and special economic zones. However, a variety of functioning legal regimes and emerging problems of their effectiveness lead researchers to the need for studying the instrument of regional innovation policy as a whole, highlighting its features, comparative characteristics of functioning special regimes, etc. It seems the studies do not fully reflect the characteristics of the special legal regime instrument.

The purpose of this study is to characterize the object of the study, namely the instrument of regional economic policy establishing a special legal regime for economic and innovative activities within the boundaries of a certain territory. Attributes (characteristic features) of special legal regimes, features and problems of using, developing, evaluating the effectiveness, etc. are the subject of the research.

The authors attributed the research tasks to the identification of the main characteristic features of the specified instrument of regional policy, main problems and features of its use, development and effectiveness evaluation.

Research Methods

The authors analysed regulatory legal acts and publications on the research topic, using generalization, systematization, comparison, interpretation, comparison.

Results

Special regimes for conducting economic activity are most often based on the industry specialization of the region, as well as on the level of initial economic development. A task of establishing special regimes for leading ("locomotive") regions and backward subsidized regions can and should differ.

In order to determine the essence of the instrument of regional policy most fully we single out the main attributes (characteristic features) and features of this tool.

1. Features of legal regulation

Most of the special legal regimes are established by the Government of the Russian Federation and formalized by appropriate decisions.

Creation of various kinds of territorial zones is governed primarily by federal laws and only then by the regional ones. As a rule, a number of legal regimes are established and regulated predominantly at the federal legislation level (territories of advanced social and economic development), while individual legal regimes have a mixed nature of regulation (special economic zones), or mainly regional (clusters, technology parks).

2. The feasibility of creation

Based on the analysis of regulatory acts, it seems a subject of the Russian Federation has to justify the feasibility of creating a particular organizational form within the boundaries of a given territory. The Government of the Russian Federation, on the basis of the justification presented, as well as compliance with the established requirements (for example, the availability of territorial planning and urban planning zoning documents, the values of specific indicators of socio-economic development for a certain period, etc.) decides on introducing a special regime and creating a zone.

3. Link to the territory

All considered legal regimes are explicitly linked to a specific territory. The boundaries of the administrative and legal regime functioning are determined at the legislative level, fixed in regulatory documents, including agreements on the conduct of activities within the territory, are linked to the territory of the subject of the Russian Federation (or municipalities in its composition).

Thus, for example, the Federal Customs Service of Russia approves (by its order of 04.30.2015 No. 817) the requirements for the arrangement and equipment of a territory of a special economic zone and the requirements for the arrangement and equipment of land plots provided to residents of the special economic zone, as well as the procedure for ensuring an access control regime in the territory, including the procedure for access to such territory.

Researchers note [19] that the law does not allow creation of several legal regimes within the same territory. Indeed, in order to avoid duplication of measures of state support, conflicts and contradictions as to the requirements of the established administrative and legal regimes, as well as to solve individual tasks of a particular legal regime, the legislation establishes restrictions on the intersection of administrative and legal regimes. For example, the legislation on territorial development zones prohibits their creation in the territories of several constituent entities of the Russian Federation (the Federal Law of 03.12.2011 No. 392-FZ "On territorial development zones of the Russian Federation and changes to certain legislative acts of the Russian Federation").

However, there may be exceptions to this rule in a form of targeted support to residents of the territory by creating other forms of innovative economy that provide specialized functions within the established administrative legal regime. These functions may be, for example, support and development of specific projects (business incubators), the innovative company reproduction (technology parks), and other forms. Their legal regulation at the level of the subject of the Russian Federation prevents duplication of the incentive measures and overlap of the established requirements.

By establishing such restrictions, the current legislation impedes integration and establishment of cooperative relations with business entities outside the territories with special operating regimes to some extent, and consequently the spread of innovation.

4. Special procedure for creation, functioning, management and termination

The Government of the Russian Federation makes decisions on the creation and termination of a number of such entities, for example, territorial development zones. A characteristic feature of the creation and functioning of zonal entities is the agreement between the Government of the Russian Federation, the executive body of a constituent entity of the Russian Federation and authorities of municipalities on the creation (management, functioning). These agreements are designed to regulate the functioning of the created territorial entity, including the stages of development, performance indicators, state support measures, mutual rights and obligations, management and disposition of land and construction of various infrastructure objects within the zone, etc.

In addition, such agreements may contain conditions for transfer of certain managing powers to the executive body of the constituent entity of the Russian Federation or a management company.

Territories of advanced social and economic development (hereinafter TOSED) are characterized by agreements with the residents of the territory, which prohibit branches and representative offices outside the TOSED, as well engaging in other activities not mentioned in the agreement. Such prohibitions seem to call for additional economic justification in a market economy. In addition, TOSED has a supervisory board consisting of representatives of government bodies, trade unions, and the management company. The supervisory board monitors the share of foreign workers engaged by the resident companies. The authorized federal body resolves any issues of urban planning and territorial planning within the TOSED.

5. Incentive measures and state support

The range of state support measures applied for residents of the considered forms of spatial organization of the innovative economy is quite wide. They include: various types of tax benefits, including accelerated depreciation, accelerated write-off of R&D expenses, investment tax loans, possibility of special customs procedures, rent with preferential rates for state-owned real estate, reduced insurance premium rates, preferential conditions for land acquisition.

A distinctive feature of special economic zones worth noting is guarantees to residents against adverse changes in the legislation of the Russian Federation on taxes and fees, guarantees of stability of investment conditions.

The state can also finance the creation of various kinds of infrastructure in the field of energy, transport, social services, and innovation infrastructure from the budget funds. In particular, it finances infrastructure in special economic zones.

An audit of the effectiveness of the use of public funds aimed at creating and developing special economic zones revealed a number of problems related to the effectiveness of the provided state support measures. In particular, a decrease in the pace of construction of infrastructure facilities, inefficient use of land, low level of control over the budget expenses, an increase in unused capacities in operation, a need to optimize the cost of maintaining management companies, etc. [20].

Researchers note creating technology parks and business incubators to be the most expensive and capital-intensive process in the field of regional innovation infrastructure. Therefore, they focus on effectiveness assessment and introduction of new assessment methods, including benchmarking [21].

6. Investment component

Implementation of various types of investment projects is one of the most important stages that contribute to economic growth and achievement of target indicators by territories with special business regimes. In fact, such territories are also a mechanism for the integrated development of the territory.

For this reason, some researchers bring the investment component to the forefront to determine the essence of the special legal regime [22]. The essence of the legal regime in this case is to help the

residents of the territory in question to engage in investment projects of various scale, that is, to invest money or other property in business entities to make profit or other useful effect.

Indeed, the considered forms of spatial organization of innovative activity in the region are characterized by tasks aimed at increasing the investment activity of entities and the established requirements for investment proposals by organizations and individual entrepreneurs who intend to become residents. Among other things, they need to indicate the estimated volumes of financial and capital investments, as well as the estimated investment dates.

One of the promising areas for the development of territories with special business regimes is the analysis of the level of investment development based on the regional specialization and providing a wider range of business activities for participants in a particular territory by choosing the most investment-attractive conditions [23].

7. Terms of operation

Legislation established deadlines for the operation of the special regimes. Thus, for example, zones of territorial development are created for a period of 12 years, special economic zones 49 years, territories of advanced social and economic development – 70 years. The terms of functioning established by law are not subject to extension.

8. Legal certainty of participants

Participants in special regimes are legal entities and individual entrepreneurs, called residents, who have entered into agreements with territorial governing bodies, as well as those included in the specialized register of residents.

9. Special status of a resident of the territory

An organization or an individual entrepreneur acquire a status of a resident of a special regime territory from the moment they are registered as a resident, make the appropriate entries in the register of territory residents, and sign an agreement on carrying out activities within the zone in accordance with the requirements of the regime. A resident of a territory with a special regime is defined primarily as an investor.

10. Features of the management of land, real estate and property

The legislation defines special regimes of land use within the boundaries of zones with special business regimes. The governing bodies of a particular regime are entitled to dispose of the land within the zone. Methods for effectiveness assessment of a special regime often include calculation of indicators of the economic effect of land use, while considering indicators of the optimal use of the territory.

Another important feature of the legal regimes is a high potential of innovative integration processes. Researchers note that the development of integration processes is not only a catalyst for innovative development, but also acts as a kind of an indicator of the balance and level of development of economic relations in the system [24]. In addition, integration processes form the identity of an industry system [25] and the system of resource support for innovative activities, [26] allow cluster enterprises to extract innovative rents and gain monopoly profit [27].

Foreign studies also pay special attention to analysing the effectiveness of the geographical and relational proximity of enterprises within one territorial zone or cluster. Researchers often conclude it influences the innovative business activity exaggeratedly [28, 29].

Thus, the main distinguishing features and characteristics of the considered instrument for organizing and developing an innovative economy (Table 1) include: the need to justify the feasibility of creating, strong integration processes within the territorial, investment processes, link to the territory, a special procedure of creation, functioning, management and termination, incentive measures and state support, fixed terms of operation, legal certainty of the participants, special legal status of the residents, specific features of the management property, the distinction between the powers of the federal centre and the subjects of the Russian Federation on the management of such areas, and others.

Table 1. Special legal regimes of functioning of economic activity as a comprehensive instrument of management of socio-economic development of regions

Types of special legal regimes	Characteristics of special legal regimes as an instrument of regional policy	Goals of creating and developing special regimes
- Areas of territorial development; - special economic zones; - clusters; - innovative industrial parks; - technopolises; - territories of advanced social and economic development; - technology parks, - free ports; - technopoles (naukograds); - international transport corridors.	- Rules for relationships between subjects; - mutual rights and obligations; - an attempt to balance the interests of participants; - link to the territory; - government support measures; - guarantees for residents; - features of state control (supervision); - reference to the territory and a clear definition of borders; - legal certainty of the participants; - fixed terms of operation; - special status of a resident of the territory; - special customs procedures; - various kinds of infrastructure; - special procedure for the management and disposal of land, real estate and property; - need for audit and performance evaluation; - need to justify the feasibility of establishing a special regime; - special procedure for creation, functioning, management and termination; - attractive investment conditions for investment projects; - strong integration processes; - distinction between the powers of the federal centre and the subjects.	- Acceleration of economic processes; - attracting investment; - development of territories; - development of production and innovation; - alignment of socio-economic development of regions.

Source: compiled by the authors.

Conclusion

The authors conducted a study of the regional economic policy instrument, which consists in establishing a special legal and economic regime for conducting economic and innovation activities within a certain territory, analysed the existing administrative and legal regimes of operation, clarified the organization requirements, the possible scale of the organization, the composition of participants, the presence of an investment component, essence of state participation and regulation, existing support measures, procedures creation and termination, duration of operation.

The authors conducted a study of a regional economic policy instrument of special legal regimes within territories. The study also formulated the main problems of the creation, functioning, development, evaluation of the effectiveness of the considered instrument of regional policy, concluded that We concluded the instrument under consideration is overly widespread and territorial zoning used excessively, while often falling short of high expectations.

The results of the study were:

1) the characteristic of the instrument of regional innovation policy, which consists in the establishment within the boundaries of a certain territory of a special legal regime for conducting economic activity;

2) formulated main features (characteristic features) of the considered instrument of regional policy;

3) formulated individual problems and features of its use, development and performance evaluation.

The novelty of the results obtained is the accumulation of the characteristics of a regional innovation policy instrument, which consists in establishing within the boundaries of a certain territory a special legal regime for conducting economic activity that can be used to develop systems for assessing the effectiveness of the use of this instrument, as well as developing new forms of regional innovative development.

The paper presents accumulated data on the characteristics of the special legal regimes which can help to develop a comprehensive system for the assessment the effectiveness of this instrument.

Summing up, it is worth noting that at present, state policy is mainly aimed at establishing the administrative-legal regime of organizational forms of an innovative economy and the criteria that subjects of innovative activity must meet in order to obtain rights to conduct economic activity within a particular organizational form. the market mechanism, as well as the synergy effect from the interaction of participants, is only weakly reflected among the organization of individual spatial forms of innovative development of territories. At the present stage of development of innovative territories of Russia, the development of the economic component of the formation of such territories seems insufficient.

The special legal regimes, though favoured by the state policy, present only a small number of cases when the synergy effect from the interaction of the participants is strong and the increase of economic indicators significant. Therefore, at the present stage of development of innovative territories of Russia the authors find the instrument to be in need for improvement.

In our opinion, the main problems associated with the special legal regimes are:

- weak justification of choosing one or another form of regional zoning or even the necessity of zoning at all;
- insufficient studies on integration processes in innovative environment;
- lack of development programs for the residents;
- an imperfect or absent system and evaluation criteria for territories;
- improper assessment of the level of shortfalls in revenues of regional budgets, etc.

The imperfection of the instrument is largely due to the novelty of the subject of regulation, limited theoretical insight into the regulation of spatial forms of organization of an innovative economy, a short period of functioning of such forms which results in inconclusive practical experience and strategic planning in this area of development.

When implementing a policy of innovative regional development, the authorities set short-term goals, while the worldwide spatial development mechanisms solve strategic, long-term tasks. The choice of spatial development mechanisms should be based on criteria suitable for specific territories considering all the reginal peculiarities.

Directions for further research

The authors refer to the areas of further research the search for the most effective ways of developing an innovative regional economy in the context of the territorial organization of the economy, analysis of the criteria for the effectiveness of planning and functioning of territorial forms of organizing an innovative economy, studying integration processes in an innovative environment, determining directions, forms and methods for the prospective development of innovative infrastructure.

In the upcoming papers, the authors intend to focus on the search for the most effective methods of regional development in terms of territorial organization, the best criteria for their effectiveness assessment, as well as further research of integration processes in an innovative environment.

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IMPLEMENTING KNOWLEDGE ECONOMY STANDARDS FOR QUALITY MANAGEMENT DEVELOPMENT OF ORGANIZATION

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Quality management is an integral part of the management of any organization. It includes effective management of all resources of the organization, including knowledge. For the digital economy, knowledge becomes the most valuable resource. The volume of intellectual assets and their management efficiency largely determine the success of the organization. Digital technologies are able to process large amounts of data, effectively structure and process them, as well as protect data from unauthorized access. These technologies will certainly be useful for various branches of modern management. Quality management is one of the most important branches of modern organization because of the ever-increasing expectations and demands of consumers, as well as competition and globalization. Thus, knowledge management is becoming an increasingly important task for every Russian enterprise. International and domestic standards offer recommendations for knowledge management, but they are not widely implemented. Many organizations have a need for knowledge management as an element of quality management of the organization, as well as a mechanism of its management. The purpose of the study is to analyze the existing international and Russian regulatory framework for knowledge management and to determine the possibility of using knowledge management technologies for the development of quality management of the organization. In the course of the study the following methods were used: analysis and synthesis, study of normative documents, modeling. Results: the research studied international and national standards of the Russian Federation for knowledge management and identified process-oriented knowledge management for the development of quality management of the organization. This process combines the approaches of quality management and human resource management and is aimed at providing the necessary level of knowledge of employees and systematization of knowledge of the organization. Directions for further research: the formation of the domestic methodological base for knowledge management, training in knowledge management and the use of knowledge management in the practice of Russian enterprises.

Keywords: digital economy, digitalization, knowledge management, knowledge, quality management

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ПРИМЕНЕНИЕ СТАНДАРТОВ В ОБЛАСТИ ЭКОНОМИКИ ЗНАНИЙ ДЛЯ РАЗВИТИЯ МЕНЕДЖМЕНТА КАЧЕСТВА ОРГАНИЗАЦИИ

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Менеджмент качества является неотъемлемой частью менеджмента любой организации. Он включает в себя эффективное управление всеми ресурсами организации, в том числе знаниями. Для цифровой экономики знания становятся самым ценным ресурсом, и успех организации

во многом определяется объемом интеллектуальных активов и эффективностью управления ими. Цифровые технологии позволяют обрабатывать большие массивы данных, эффективно их структурировать и обрабатывать, а также защищают данные от несанкционированного доступа. Данные технологии безусловно будут полезны для различных отраслей современного менеджмента. Менеджмент качества является одной из самых значимых отраслей современной организации. Это обусловлено постоянно растущими ожиданиями и требованиями потребителей, а также конкуренцией и глобализацией. Таким образом, менеджмент знаний становится все более актуальной задачей для каждого российского предприятия. Международные и отечественные стандарты предлагают рекомендации по менеджменту знаний, но внедрены они далеко не везде. Многие организации имеют потребность в менеджменте знаний как в элементе менеджмента качества организации, а также в механизме его ведения. Цель исследования: проанализировать существующую международную и российскую нормативную базу по управлению знаниями и определить возможности применения технологий управления знаниями для развития менеджмента качества организации. В ходе исследования были применены следующие методы: анализ и синтез, изучение нормативных документов, моделирование. Полученные результаты: в ходе исследования были изучены международные и национальные стандарты Российской Федерации по менеджменту знаний и был выявлен процессно-ориентированный менеджмент знаний для развития менеджмента качества организации. Данный процесс комбинирует подходы менеджмента качества и управления персоналом и нацелен на обеспечение необходимого уровня знаний сотрудников и систематизацию знаний организации. Направления дальнейших исследований: формирование отечественной методической базы по управлению знаниями, подготовка специалистов по менеджменту знаний и применение менеджмента знаний в практике российских предприятий.

Ключевые слова: цифровая экономика, цифровизация, управление знаниями, знания, менеджмент качества

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Introduction

Digital transformation of economy and industry is the most relevant topic of modern scientific and commercial discussions. Digital technologies penetrate every person's life through different roles and tasks. The government and business also face the need for effective use of the tools of digitalization in their work. According to KMDA, a consulting company for digital strategy and business transformation, only 9.1% of the surveyed companies are not engaged in digital transformation, while the rest are already at various stages of research, development and implementation of new technologies [1].

Knowledge management and digital transformation were addressed by A.V. Babkin [2, 3], E.A. Gromova [4], E.S. Balashova [5], A.E. Karlik [6] and other.

The digital transformation of the economy and industry has influenced changes in the regulatory framework: there are a number of international and national standards governing the application of its capabilities. The study covers aspects of knowledge management.

Purpose of research

This study is aimed at studying the knowledge economy, the determination of the place of knowledge management in this process and the identification of opportunities for applying technologies of knowledge management for the development of quality management of the organization.

To achieve this goal, the following issues have to be considered:

1. learning the concepts of digital transformation of the economy and knowledge economy, its current state and the main drivers, the impact of digital transformation of the economy on the development of management systems, in particular quality management;

2. analyzing the existing international and Russian regulatory framework for knowledge management;
3. study of process-oriented knowledge management for the development of quality management and digital transformation of the economy.

The object of the study is the quality management system of organization, we consider the subject of knowledge management within its framework.

Method of research

To achieve these goals, the study analyzed the existing regulatory framework for knowledge management and quality management, also using the methods of synthesis and modeling, comparative analysis.

Obtained results

In the research of the Sretensky Club, digital economy is an economy in a hybrid world [7]. Hybrid world is understood here as a fusion of the real and virtual world.

Digital transformation is implemented as a part of economic development: mechanization, convection, digitalization, platforming. Digital platforms and information and communication technologies are of great importance for digital transformation. However, the competence of the digital economy includes information technology (big data, blockchain, etc.), economics (macroeconomics, microeconomics, business models, marketing, etc.) and management (asset management, functions, processes, people, resources, project approach, etc.) [8]. Thus, information technology forms the infrastructure and tools, but people remain to be the owners of the processes. This can explain the apparent spread of modern startups, when entrepreneurs were at the same initial level, but the creativity and aspirations of a few individuals gave them entrepreneurial success. Knowledge, its volume and efficiency of use are the most important criteria for the success of most organizations, regardless of the form of ownership and the number of personnel, and knowledge management is becoming one of the most important tasks of management.

Management of the organization covers different scopes, including quality (products, services, business processes). This is a system concept.

Quality management system is one of the tools for the organization development. The quality management system is a management system for the management of the organization in relation to quality [9]. To date, the vast majority of Russian enterprises are building their work on quality management in the form of a quality management system that meets the requirements of national standards of the ISO series. This series of standards covers all areas of management of the organization and is aimed at ensuring compliance of products and processes of the organization with the declared requirements. The latest edition of the National standard GOST R ISO 9001-2015 focuses on knowledge and risk management, emphasizes the importance of human resources of the organization and their role in its sustainable success [10]. In particular, the standard contains the following requirements for knowledge management (KM) of personnel (Table 1).

Table 1. Requirements of GOST R ISO 9001-2015 related to knowledge management of the organization

Standard section	Contents
4. Environment of the organization	Values, culture, knowledge as factors of internal environment
7.1.6. Knowledge of organization	The objectives of the organization are to determine the knowledge needed for the functioning of its processes and to achieve conformity of products and services; to ensure their availability and sufficiency. The organization should also assess the current level of knowledge and determine how to obtain or provide access to the necessary knowledge and its necessary updates.

7.2. Competence	The organization must: a) determine the necessary competence of person(s) performing work under its management, which has an impact on the performance and effectiveness of the quality management system; b) ensure the competence of these persons on the basis of appropriate education, training and (or) experience; c) where applicable, take actions aimed at obtaining the required competence and evaluate the effectiveness of the actions taken; d) record and retain relevant documented information as evidence of competence.
7.4. Exchange of information	The organization should determine the procedure for the exchange of internal and external information related to the QMS.

Standard GOST R ISO 9001-2015 provides an initial point for the work on the knowledge and competence of management employees. Following this standard gives the organization the first developments, but does not provide an understanding of knowledge management as an integrated system or practical recommendations for the implementation of such.

Many theories and approaches have been developed for the implementation of knowledge management processes in the world practice [11]. The experience of implementing systems and processes of knowledge management organizations is also great, but their study is complicated due to the fact that knowledge management data, as well as the knowledge itself, are a competitive advantage of the company and kept secret.

From the point of view of management, knowledge is an object of management and personnel management, as well as quality management. Recently the study of knowledge acquired an independent discipline, knowledge management.

In international practice, we can find a set of standards for knowledge management CWA 14924:2004 (Table 2). This guide to established knowledge management practices includes five standards dealing with different aspects of knowledge management [12]. These standards were developed on the basis of the analysis of the activities of a number of foreign companies and do not take into account the Russian specifics.

Table 2. European knowledge management standards

Standard Number	Title
CWA 14924-1:2004	European Guide to good Practice in Knowledge Management. Part 1: Knowledge Management Framework
CWA 14924-2:2004	European Guide to good Practice in Knowledge Management. Part 2: Organizational Culture
CWA 14924-3:2004	European Guide to good Practice in Knowledge Management. Part 3: SME Implementation
CWA 14924-4:2004	European Guide to good Practice in Knowledge Management. Part 4: Guidelines for Measuring KM
CWA 14924-5:2004	European Guide to good Practice in Knowledge Management. Part 5: KM Terminology

In response to the need for guidance on the organization of the knowledge management process, a number of national standards have been developed. Some of them are theoretical and serve as a basis for initial discussions [13], others contain a set of specific actions on knowledge management. It is important to note the absence of references in the documents to national experience in knowledge management. The subject of the study is closely related to corporate culture, mentality and state institutions, so it is advisable to include Russian experience in these standards. An example is the website "How to manage knowledge" containing a number of articles by the Russian expert on knowledge management Maria Marinicheva. It reflects the national experience and practical recommendations for knowledge management implementation [14].

The following national standards for knowledge management are currently in force (Table 3).

Table 3. National knowledge management standards of Russian Federation

Standard number	Title
GOST R 54875-2011	Knowledge management. Guide to the established practice of implementing a knowledge management system
GOST R 53894-2016	Knowledge management. Terms and definitions
GOST R 57132-2016	Knowledge management. Relationship with organizational functions and disciplines. A guide to best practice
GOST R 57127-2016 / PAS 2001:2001	Knowledge management. A guide to best practice
GOST R 57133-2016	Management of organizational culture and knowledge. A guide to best practice
GOST R 57134-2016	Knowledge management. Mastery of knowledge acquisition. A guide to best practice
GOST R 57319-2016	Knowledge management. Guidance for the successful achievement of small business goals
GOST R 57320-2016	Knowledge management. Application of process-oriented knowledge management in small and medium-sized enterprises.
GOST R 57321.1-2016	Knowledge management. Knowledge management in the field of engineering
GOST R 54874-2016	Knowledge management. Best practices guide for the public sector
GOST R 57325-2016 / ISO / IEC Guide 17: 2016	Knowledge management. Guidance on the incorporation of micro, small and medium-sized enterprise (MSME) requirements into standards)
GOST R 57331-2016/ PAS 1063:2006	Knowledge management. Guide to the practical application of knowledge management in small and medium-sized enterprise networks

Analysis of the above standards in the field of knowledge management indicates that the effective implementation of knowledge management in the organization carries the need for appropriate corporate culture and attitude to knowledge, support from management and the priority of business goals in the strategy of knowledge management. Close cooperation with the departments of personnel, quality and information technology will give a powerful impetus to the development of this area of management.

We should note the specifics of these standards: most of them are only the basis for initial discussions and demonstration of the benefits of the future implementation of the KM in enterprises.

The national standard GOST R 57320-2016 "Knowledge management. Application of process-oriented knowledge management in small and medium-sized enterprises" plays a special role. This document is a methodology of well-established practice of consistent implementation of knowledge management in enterprises. The standard aims to introduce process-based knowledge management (PBKM) in small and medium-sized enterprises (SMEs). The peculiarity of SMEs is a relatively small resource base. It implies, on the one hand, cost-effective implementation solutions, and on the other, mandatory testing of the effectiveness of innovations, for small companies need only specific working tools, and the budget for general training and motivational activities is usually cut. The presented approach can be applied independently of the industry and should be considered as a guide [15]. Consistent implementation of the KM systematizes processes and information flows, provides an up-to-date regulatory framework and streamline data on product quality.

The knowledge management process is divided into the following phases: initialization, analysis, pilot phase, implementation and sustainable development phase.

Table 4 shows the initial data, main tasks and results of each phase. Each phase as a process has its own input (source data), a set of tasks and control points of the result. Thus, it is possible to track the status of the process, evaluate its effectiveness and, if necessary, adjust the process or allow for errors in subsequent cycles. The gradual implementation of the PBKM is also important as gradual implementation from process to process increases the efficiency of individual processes, is of interest to employees and eliminates the formal implementation.

Table 4. PBKM implementation algorithm

Phase	Input	Main tasks	Results (check points)
A. Initialization (start-up initiatives)	Environment of the organization Management's view of the KM	Setting specific achievable goals and checking the conditions for the possibility of implementing the PBKM	PBKM goal Project team
B. Analysis	Culture and processes of organization	Culture analysis, process selection and in-process analysis of the five main activities of the KM	The strengths and weaknesses of the culture of the organization for the development of KM are determined The most important processes of the organization are identified Pilot process is selected
C. Pilot phase	Pilot process and knowledge areas of the organization	Process description Knowledge representation and structuring Evaluation of results The decision to implement	The process is optimized, the effect is approved Decision to implement the KM process made
D. Implementation	Pilot process	Removing possible obstacles Qualification of employees Consistent implementation (repetition of phases B and C)	Interest in PBKM among employees The increase in the number of PBKM processes
E. Sustainable development	Resources	Creating the structure of continuous improvement	KM is an integral part of daily work

Identification, creation, storage, dissemination and application of knowledge are the main activities of the KM [16]. This activity can relate to both external and internal knowledge of the organization, which affects its competitive advantages and relationships with partners.

This approach fits into the popular process approach of the quality management system PDCA (Plan-Do-Check-Act): there is a process of setting the task, the mechanism of its implementation, evaluation of the effect and proposals for improvements [17]. As a result, the PBKM will have a positive impact on the quality management system of the organization and make it more popular among employees, as knowledge management affects the organization of their workplace, optimizes their work and creates a friendlier atmosphere of cooperation and continuous improvement.

According to E.A. Balashov, the main obstacle in the implementation of the KM will most often be the low culture of Russian organizations and the low level of the use of information technologies [18]. The digital transformation in the form of the use of modern digital technologies, as well as the development of business on network technologies will help to overcome these obstacles. Franchising is a successful example of such cooperation. According to this business model, knowledge takes the form of work standards and is translated into franchisee firms. This is how the system of partnership is built, and a larger scale of business gets the opportunity to introduce more expensive systems and technologies that are not available to individual small and medium-sized enterprises [19].

Thus, the following results were obtained during the work:

1. The international practice of knowledge management aims to link the tools of information technology, personnel management and quality management of the organization into a single system.

2. The Russian practice has developed a base of standards for knowledge management, however, they have not yet been widely used.

3. In the research we studied process-based knowledge management using the quality management approach. When embedding process-based knowledge management in the quality management system, the latter receives a powerful development. Knowledge management takes the form of a subsystem, based on existing information and communication and administrative resources. For enterprises, it is a method of implementing knowledge management to improve the quality management system of the organization,

form of a more powerful culture of building knowledge of the company and optimize the knowledge used in various business processes of the organization.

Directions for further research

Further development of knowledge management in the enterprise may consist in the optimization of knowledge management software under the approved architecture, as well as the development of internal criteria for measuring knowledge. The crucial purpose of Russian government is the formation of the domestic methodological base for knowledge management. The training of specialists in knowledge management is also important. The American Productivity and Quality Center notes the following competencies required by knowledge management professionals: systems thinking, collaboration and communication, strategic planning, and change management [20]. The demand for change management expertise is not surprising given the ubiquity of digital transformation initiatives and the accelerating pace of change in general.

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DEVELOPMENT OF NON-GOVERNMENTAL EDUCATIONAL SERVICES IN THE CONDITIONS OF DIGITAL ECONOMY

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With the transition to market relations, the demand for educational services increases, but the state cannot fully satisfy it due to a lack of budgetary funds. The contradiction between the increasing educational demands and the possibilities of satisfying them only on a state basis are the reason for the emergence of the non-state sector in the education system. One of the main tasks of higher education institutions around the world is the training and retraining of qualified personnel that meet the requirements and technologies of our time. The creation of new and innovative higher education institutions, the creation of online forms of training, and new methods for the training and retraining of young specialists are progressive reforms in the field of education. In the context of the digitalization of the economy, the demand for educational services is growing many times over, as the modern labour market needs personnel with additional knowledge in the field of information technology. The main source of development of the digital economy are specialists trained to work with information technology. If, on the one hand, the requirements for training in information technology are included in the professional standards for teachers, then on the other hand, preparation for using IT goes beyond technical competencies and requires an expanded understanding of the methodological preparation of teachers for work in the electronic educational environment. It should be noted that in the digital economy, many workers could become unclaimed due to wide employment of artificial intelligence. But along with this, new professions necessary in every branch of the economy will appear. And the training of such personnel in a short period of time can be carried out by non-governmental educational institutions using information technology.

Keywords: digital economy, innovative economy, labor market, centralized education, knowledge economy, non-governmental education services

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РАЗВИТИЕ НЕГОСУДАРСТВЕННЫХ ОБРАЗОВАТЕЛЬНЫХ УСЛУГ В УСЛОВИЯХ ЦИФРОВОЙ ЭКОНОМИКИ

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С переходом на рыночные отношения спрос на образовательные услуги увеличивается, но государство не может удовлетворить его в полной мере из-за нехватки бюджетных средств. Противоречие между увеличивающимися образовательными запросами и возможностями их удовлетворения только на государственной основе является причинами возникновения негосударственного сектора в системе образования. Одной из основных задач высших учебных заведений во всем мире является подготовка и переподготовка квалифицированных кадров, отвечающих требованиям и технологиям современности. Создание новых инновационных высших учебных заведений, создание онлайн-форм обучени, и новых методологий подготовки и переподготовки молодых специалистов являются прогрессивными реформами

в сфере образования. В условиях цифровизации экономики запросы на образовательные услуги возрастают многократно, так как современному рынку труда необходимы кадры с дополнительными знаниями в области информационных технологий. Главным источником развития цифровой экономики являются специалисты, подготовленные к работе с информационными технологиями. Если, с одной стороны, требования к подготовке по информационным технологиям включены в профессиональные стандарты педагогов, то, с другой, подготовка к использованию ИТ выходит за пределы технических компетенций и требует расширенного понимания методической подготовки преподавателей к работе в электронной образовательной среде. В условиях цифровой экономики многие работники могут стать невостребованными по причине широко использования искуственного интеллекта. При этом появятся новые профессии, которые будут необходимы в каждой отрасли экономики. Подготовку таких кадров за короткий промежуток времени могут осуществить именно негосударственные образовательные учреждения, используя информационных технологии.

Ключевые слова: цифровая экономика, инновационная экономика, рынок труда, централизованное образование, экономика знаний, услуги негосударственного образования

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Introduction

Economic development of the whole world and each individual state is based on the concept of global development of human potential, which is directly related to the development of the education system.

Today, in an innovative economy, the difference between countries will increasingly depend on the state of education systems and the quality of human resources, which is determined by the level of the physical, moral and intellectual potential of the population [1].

The education system is a single focused process of education and training, which is a socially significant benefit carried out in the interests of a person, family, society and the state, as well as a combination of the acquired knowledge, skills, values, experience, competencies of a certain volume and complexity for the purpose of intellectual, spiritual, moral, creative, physical and professional development of individuals, satisfaction of their educational needs and interests[1].

In the modern world, the position of each country is determined by its intellectual potential. The most developed countries of the world receive up to 40% of the GDP growth as a result of the development of an effective education system. Investments in education pay off most quickly. According to American experts, 1 dollar invested in the education system allows you to get a profit of 3–6 dollars [2].

As the Russian economist O.T. Bogomolov wrote: "The effectiveness of innovative development depends on the development of democratic institutions, as well as institutions for managing and maintaining order, and the quality of the political and business elite. Overcoming acute crisis processes is impossible without the development of education, training and upbringing of the younger generation" [3].

In the context of economic modernization, the most important tasks of a research in the field of education economics are:

- determination of the permissible boundaries of the market mechanism in the education system, and in particular in general education;
- substantiation of the correlation of the role of the state and the education market by system levels;

[1] Article 2 of the Federal Law of December 29, 2012 No. 273 "On Education in the Russian Federation". URL: https://base.garant.ru/58060755

• substantiation of methodological approaches to the development of a system of economic relations in education and construction of a conceptual model of this system;

• determination of the conditions and directions of reforming the system of economic relations in education and development of a set of specific mechanisms for the implementation of innovations.

In the context of the transition to the digital economy, it is necessary to change the view on education, since it is an object of promising and important investments. The state and effectiveness of an education system determines the prospects and future appearance of the country, its production potential, standards of living, and international status.

In recent years, the leading countries of the world have begun transforming their education systems, sometimes resulting in deep multifaceted reforms.

In all countries of the world in the era of industrial development, advantages were given to natural and labour resources, material resources gradually became of importance. Under current conditions, the main factors in the development of the economy are intellectual and information resources [4].

According to the definition presented in the Oxford Dictionary, "digital economy is an economy which functions primarily by means of digital technology, especially electronic transactions made using the Internet[2]" [5].

Intellectual potential is the main driving force of the modern economy, since it is based on the elements of the "knowledge economy" [6].

A distinctive feature of the "knowledge economy" is the accelerated development of the intangible sphere and the intangible environment of economic activity. The production, distribution and use of knowledge form the basis of the new economy, and its infrastructure is the global information network, which significantly reduces the material-resource and spatial limits of growth rates [7].

In accordance with the "knowledge economy", the development of the leading countries of the world has led to a new stage of development based on knowledge, innovations, global information systems and new technologies.

It should be noted that in the digital economy, the labour market will urgently need modern specialists, training of which requires early introduction of innovations in the education system. These innovation, results of scientific progress, of course require certain financial costs and time.

Non-state vocational education, which has the ability to quickly respond to consumer requests and changes in the requirements of the specialist market, can make up for this deficit, which ensures its competitiveness and prospects.

Purpose of the study

The study and application of digital tools in creating infrastructure in the field of education, analysis of the role and place of non-state education at the present stage of information technology.

Research Methodology

This paper reviews and analyses existing publications, open source data and information on education in the digital economy. The author employed comparative and SWOT analyses of existing solutions to the identified problems.

Main part

The education system is expanding the use of digital technologies. Educational organizations have their websites in the Internet in accordance with the state requirements. The course of informatics and information and communication technologies in general education programs has been provided normatively, technologically, and substantively; personnel are being trained for the digital economy.

[2] https://www.lexico.com/en/definition/digital_economy

However, a number of people in training and the relevance of educational programs to the needs of the digital economy are insufficient. There is a serious shortage of personnel in the educational process at all levels of education. In the procedures of final certification, the use of digital tools in education is scarce, the process is not integrated into the digital information environment [8].

In the era of the global transition of the digital economy and the labour market to all sectors of society, the education system must also be developed on the basis of market relations. In market economy, the government struggles to cover or finance certain industries, and the market mechanism allows it to receive the education it needs for self-financing.

For the modern economy, you need an employee who, in addition to professional competencies, has the skills to work with digital tools. Therefore, the requirements of educational standards, programs, a list of competencies that tend to change constantly and increase the speed of knowledge are put forward to graduates of higher educational institutions [9].

The improvement of human capital is an important factor in the development of the digital economy. Higher education, as a rule, provides fundamental basic knowledge, which must be constantly supplemented by modern discoveries, skills and technologies that are provided by non-governmental education.

In a time of digitalization of the economy and adaptation to the rapid exchange of information, there is a need for a society to have a modern and progressive, market-oriented education system that is based on innovation at its own expense, incorporating innovation in all areas of life. It is natural, that a non-governmental educational services market is emerging, given the importance of such educational services for sustainable economic development.

As a result of economic development, the labour market requires the education system to create three products based on modern information programs: labour, education and scientific-technical areas. At the same time, it is advisable to meet the demand not only through government funding, but in partnership with the private sector in various forms of ownership. As a non-governmental education system can quickly adapt to the needs of the innovative market, it can provide the necessary educational services which can satisfy community needs, of individuals or organizations, and conduct custom research activities. Therefore, the emergence, formation and development of a non-governmental education system with greater capacity to carry out these tasks is desirable.

The economic potential of a country is provided by human resources. Staffing is shaped by self-education. The role of higher education is invaluable. In a digital economy, the education system, especially higher education, has high requirements. One of the key aspects of the digital economy is a reduction of jobs for low-skilled workers in each country. Finding a job without an education can be difficult, even impossible. Anyone wishing to earn a higher salary must have not only a general education, but also a specialized professional education, and often a higher education. At the same time, the demand for higher education within the country will increase dramatically. As a result, higher education is becoming popular all over the world.

According to UNESCO, the number of students worldwide was 97 million in 2015, and by 2025 it will reach 100 million [10].

Non-governmental education plays a vital role in meeting this demand.

At this stage of development of the society, it has become clear that in order to have a decent standard of living, one must improve one's intellectual abilities throughout their lives. That is, they will have to constantly improve their qualifications to become skilled professionals or have some knowledge. In order to fully meet the requirements of the time, it is necessary to have a new profession and a new profession. In non-governmental educational institutions, it is possible to provide these services in a short term. In contrast to centralized education, these institutions are equipped with modern technology, with the shortest duration of training or the opportunity to operate in innovative teaching methods.

The main source of development of the digital economy are specialists trained in working with information technology. On the one hand, the requirements for IT training are included in the professional standards of teachers, and on the other, preparation for using IT goes beyond the technical competencies and requires an expanded understanding of the methodological preparation of teachers for work in the electronic educational environment. The system of training teachers to work in a modern digital educational environment is currently only being formed.

It should be noted that in the digital economy, many specialties will become unclaimed due to some jobs being occupied by artificial intelligence (AI). But along with this, new professions will appear that will be necessary in every branch of the economy. And training of such personnel in a short period of time can be carried out by non- governmental state educational institutions.

Results

E-learning and distance learning technologies form a segment of online higher education programs, the share of which does not exceed 2%. Online educational programs are mainly provided by non-governmental educational institutions; their share in the online learning segment reaches 80%.

Universities need to fill the created digital educational environment with their educational products, interactive content, tools for interaction and project activities of students, then the benefits of the digital economy will become available to them [11].

For full participation in the formation of the digital economy through training, as well as the industry of the digital economy, some steps should be taken to support universities in informatization. A student of an educational institution is not only an educational object, but also a payer for education services.

Today, higher education in Uzbekistan prepares qualified specialists for various spheres of public life and sectors of the economy: scientific, economic, technical and others. The educational process systematises knowledge and acquired skills, orienting students to solving theoretical and practical problems in the vector of the chosen specialization with the creative use of the achievements of modern scientific thought and technology [12].

In January–June 2017, a group of international experts involved in collaboration between UNESCO and the consulting company DGP Research & Consulting conducted a comprehensive study of the education system of Uzbekistan. Based on the results of the analysis, proposals were developed on the need to further ensure the integrity of theory and practice, improve the mechanism for monitoring the quality of education, and develop effective cooperation with foreign universities.

Reforms in the field of higher education in Uzbekistan are being implemented in cooperation with many international organizations, including Erasmus + (European Union program), JICA (Japan International Cooperation Agency), KOICA (Korea International Cooperation Agency).

As a result of these joint programs, hundreds of teachers and students of Uzbekistan have the opportunity to get acquainted with international best practices in the education system, acquire new knowledge and skills, and improve their skills in leading universities in the world. An equally important defining criterion that directly affects the quality of the educational process is the current level of the university's research activities, the introduction of research results in the educational process.

It is the research activity that allows its leading professors, associate professors, scientific workers to be at the forefront of the development of scientific knowledge and to transfer this knowledge to students and graduate students. The development of education in our country can no longer be considered separately from the development of science, only the unity of science and education will allow these areas of human activity to function correctly [13].

One of the most effective tools that contribute to quality education, of course, is information technology. In modern conditions it is impossible to separate the educational process from the use of new information technologies. Their introduction into lecture courses, seminars and practical classes

allows us to optimize the process of presentation and assimilation of the material studied, which will undoubtedly improve the quality of education [14].

With an increase in the quality of training and retraining of specialists, the role of higher education institutions is significant. The quality of knowledge obtained in higher education institutions is associated with the level of competence of students, the intellectual potential of the teaching staff and the highest level of teaching methods. New programs, attracted faculty, category of trained students, modern technologies ensure the perfection and attractiveness of higher education institutions [15].

The report of the Centre for Economic Research cited that with almost 100% coverage of the secondary education system and 9% coverage of the higher education system, it turns out that 9 out of 10 school graduates cannot go to university, while the demand for higher education is high, and there is a competition at universities exceeding 6 people per place. Of the students entering universities, 60% are men (the proportion of women in universities has declined in recent years, unlike other countries in the region) [16].

The final part

Although the student enrolment rate was already 20% in the school year 2019–2020, this is still not enough with the current demand for higher education.

You also need to pay attention that most of the universities are located in Tashkent. And in order to get higher education, graduates have to come from all regions to the capital, which burdens them with additional expenses. [17].

Therefore, in order to eliminate the shortage of highly qualified specialists, which is growing rapidly in the current conditions, it is necessary to abandon the educational monopoly (especially for higher education), and give more opportunities to non-state education. In a short time, it can introduce achievements in the field of science and technology, modern information technology, thereby qualitatively meeting the requirements of the labour market [18].

Conclusions

Based on the above, it became necessary to conduct a SWOT analysis of non-state educational institutions. As a result of a study of the activities of non-governmental educational institutions, the authors revealed such qualities as a quick response to labour market demand, training of highly qualified personnel in a short time, a possibility of creating non-governmental educational institutions, based on industrial production, which allows for effective integration of theory and practice [19].

Therefore, the following conclusions can be made:

1. Non-state education has a more flexible approach to the requirements of the modern labour market.

2. The private sector will be able to train highly qualified specialists in a short time for all areas of the economy using digital technologies.

3. With the creation of educational institutions in private industrial enterprises, integration between education and production can be achieved.

4. With the development of the private education sector, healthy competition will arise between state and non-state educational institutions to obtain modern knowledge.

Along with this, there are some drawbacks of non-governmental education, such as a lack of public perception of such education as an addition to state higher education, an absence of tax benefits and preferences when renting the premises necessary for the organization of non-governmental educational institutions, mistrust of employers towards graduates of non-state educational institutions.

Non-governmental education threatens to replace state education completely, as a result of competition for the provision of services in the field of education, it can generate high income and turn education into a profitable business.

In accordance with the World Bank's definition, the digital economy is a system of economic, social, and cultural relations based on the use of digital and information and communication technologies.

In recent years, Uzbekistan has been working to improve the socio-economic situation and establish higher educational institutions that meet world standards of education.

Despite the fact that Uzbekistan rose by 8 positions in the International Index for the Development of Information and Communication Technologies in 2019, we are still lagging behind drastically in this area. It is no exaggeration to say that most of our ministries, departments, and enterprises are still far from the full implementation of digital technologies [20].

Directions for further research

The wide implementation of digital technologies contributes to the efficiency of government and public administration, the development of the social sphere, the fundamental improvement of people's lives.

For consecutive continuation the new, modern level of the work on development of the sphere of science and education in progress, upbringing of our youth by the persons having profound knowledge, high culture and spirituality, as well as the encouragement of a competitive economy, the year 2020 in Uzbekistan is proclaimed to be the "Year of development of science, education and digital economy"[3].

The Concept of Development of Higher Education of the Republic of Uzbekistan till 2030 introduces radical reform of the education system, especially the development of public-private partnerships in higher education, organization of higher education institutions in the regions. An increase of coverage by 35% by 2025, and by 50% by 2050, is aimed at creating a healthy competitive environment in the industry[4].

It is clear that non-governmental educational institutions play a great role in achieving these high levels. Consequently, there are many opportunities for businesses and foreign investors to develop education in the country, including higher education.

However, the continuity and economic benefits of investing in the non-government sector of education have not been theoretically analysed. This will be an incentive for further research in this area.

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STUDY ON THE IMPACT OF E-COMMERCE DEVELOPMENT ON INFLATION IN THE EURO AREA

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This article explores the impact of e-commerce development on inflation in the euro area. Low inflation in the euro area has been a concern for policymakers since the global economic crisis. Economic growth and inflation have recovered in many countries, but in the euro area, growth has remained sluggish and inflation low. As a result, to reach its inflation target the European Central Bank cut its policy rate to zero and implemented several non-standard monetary measures. The possible cause of the disinflation could be digitalization and e-commerce development. With the development of digital technology and the internet, company competition may increase, and costs will decrease. The main hypothesis of the study is that the developing e-commerce sector may channel into lower consumer inflation. The e-commerce development was measured by two indicators, namely a share of online purchases by individuals and a share of purchases by enterprises via a computer network. To evaluate the impact of e-commerce, a panel database on 19 euro area countries was compiled. Initially, a cross country analysis shows no negative relationship between e-commerce development measures and inflation. However, a basic linear panel model with fixed effects and a panel vector autoregression showed negative impact of e-commerce development and digitalization on inflation. As a result of a panel analysis, the hypothesis of the disinflationary impact of e-commerce was generally confirmed. However, given a weak relationship between e-commerce development and inflation in a basic cross-country analysis, the negative relationship was likely attributable to the ongoing upward e-commerce development trend. The trend has a natural cap of 100%, meaning that this disinflationary factor will eventually fade away. For many countries, in 2019, the share of online purchases by the population was below 50%. Should the trend stop, inflation in the euro area may accelerate. Among other factors hindering the e-commerce development and digitalization are tighter information technology regulation and worsening international trade relations.

Keywords: e-commerce, digitalization, inflation, eurozone, panel linear model, PVAR, monetary policy

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ИССЛЕДОВАНИЕ ВЛИЯНИЯ РАЗВИТИЯ ЭЛЕКТРОННОЙ ТОРГОВЛИ НА ИНФЛЯЦИЮ В ЗОНЕ ЕВРО

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В статье рассматривается влияние развития электронной коммерции на инфляцию в зоне евро. Низкая инфляция в зоне евро была проблемой для мировой экономики после глобального экономического кризиса. Экономический рост и инфляция восстанавливались во многих странах, но в зоне евро рост остался вялым, а инфляция низкой. В результате Европейский центральный банк для достижения целевого показателя по инфляции снизил ставку до нуля и принял ряд нестандартных мер денежно-кредитной политики. Возможной причиной дезинфляции может быть цифровизация и развитие интернет-торговли. С развитием цифровых технологий и интернета конкуренция компаний может повысится, а издержки

снижаются. Основная гипотеза исследования заключается в том, что развивающийся сектор электронной коммерции может привести к снижению потребительской инфляции. Развитие электронной коммерции измерялось двумя показателями: долей покупок через интернет физическими лицами и долей покупок предприятий по сети. Для оценки влияния электронной торговли была собрана база данных по 19 странам еврозоны. Первоначально межстрановой анализ не выявил отрицательной связи между показателями развития интернет-торговли и инфляцией. Однако базовая линейная модель панельных данных с фиксированными эффектами и векторная авторегрессия показали негативное влияние развития электронной коммерции и цифровизации на инфляцию. В результате панельного анализа гипотеза о дезинфляционном влиянии электронной коммерции была в целом подтверждена. Однако, учитывая слабую взаимосвязь между развитием интернет-торговли и инфляцией в базовом межстрановом анализе, отрицательная связь, вероятно, была обусловлена продолжающимся трендом развития интернет-торговли. Тренд имеет естественный предел в 100%, т.е. этот дезинфляционный фактор со временем исчезнет. Пока еще у многих стран в 2019 году доля покупок населения в интернете была ниже 50%. В случае остановки тренда инфляция в зоне евро может ускориться. Среди других факторов, сдерживающих развитие электронной коммерции и цифровизацию, могут быть более жесткое регулирование информационных технологий и ухудшение международных торговых отношений.

Ключевые слова: интернет-торговля, цифровизация, инфляция, зона евро, панельная регрессия, панельная векторная авторегрессия, ДКП

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Introduction

Consumer inflation is becoming a more and more important indicator around the globe. Stable price growth may reduce uncertainty for economic agents and support general economic activity. The monetary policy in many countries now involves inflation targeting aimed at achieving a sustainable target level of inflation.

Despite loose monetary policy in the euro area, inflation remains low amid the expansion of e-commerce and digitalization. The mechanism behind the disinflation caused by digitalization and e-commerce expansion may lie in increasing competition and cost reduction. These channels were statistically confirmed in [1]. Internet access made it easy for consumers to find and purchase any goods or assets from a vast variety of suppliers. On the other hand, this availability could reduce the barriers for the suppliers and sellers, spreading information about the goods and distributors. This view was cited in [2]. Moreover, the internet allows substituting traditional distribution channels for enterprises reducing their costs. This aspect of digitalization and e-commerce impact on inflation was studied in [3]. The authors measured the impact of digitalization at about -0.04 to -0.13 percentage point on inflation from a 1% increase in the percentage of internet users to the total population.

Papers [2], [4], and [5] show the similarity between offline and online price dynamics. However, online prices change more frequently. These studies were conducted on the shopping platform database and a price-comparison website. This also means that price indices could reliably represent the actual price dynamics even if they were based on offline prices.

Digitalization may also lead to higher productivity. Papers [2, 6, 7] advocate that increased productivity arising from digitalization of various sectors may eventually lead to slower inflation. Firstly, increased productivity may result in lower costs. Secondly, automatization and new skill requirements for new technologies may result in job displacement. Therefore, labor income and aggregate demand would be suppressed. The related framework was described in [2] and [6]. In article [7] authors highlight the importance of large multinational corporations for lower inflation. New technologies and the development of e-commerce allow large technology companies to increase their market share. Higher market

concentration may lead to higher income inequality and lower demand. Paper [8] studied heterogeneity of companies due to technology diffusion. The authors revealed a productivity gap among companies and singled out a group of the most productive large multinational corporations.

The object of this study is inflation dynamics in the euro area.

The goal of this study is to estimate the impact of e-commerce development on inflation, given the country-specific parameters and the European Central Bank's monetary policy.

The objectives of this article are:

1) To reveal a statistical relationship between e-commerce development and inflation;

2) To estimate the impact of e-commerce development based on a panel model;

3) To estimate the impact of e-commerce development based on a PVAR model and compare it with the panel model estimate in 2);

4) To compare the impact of monetary policy with and without accounting for the e-commerce development.

The main hypothesis of this article is that the e-commerce development and digitalization may have a disinflationary impact. Since the low global inflation now mostly concerns developed economies, the study considered the euro area. Besides, the euro area is an interesting case due to an unconventional monetary policy conducted by the European Central Bank (ECB) and heterogeneity of the country-members.

The standard instruments of monetary policy of the ECB include short-term interest rates regulation via open market operations, required reserves rate, and standing facilities [9]. Apart from the standard measures, many central banks have implemented unconventional measures of monetary policy, which include negative interest, forward guidance, and asset purchases programs. The ECB also introduced these unconventional measures following the world economic crisis to improve its monetary policy efficiency. The ECB sets the level of short-term interest rates in the economy via standard policy measures, while the quantitative easing policy expands the ECB's balance sheet and allows to manage the long-term interest rates.

The specifics of the euro area are the heterogeneity of the economies reflected by the economic dynamics and the debt level across countries. The banking sector also plays an important role in the monetary policy transmission in the euro area. The ultra-low interest rate environment suppresses margins for the banking sector, though it could be offset by other sources of income.

Research methodology

To test the impact of monetary policy on inflation, we can use statistical and econometric analysis. After a preliminary statistical analysis, two econometric models were estimated. The variable of interest in both models was consumer inflation measured by the harmonized index of consumer prices at the national level. This indicator was built on similar consumer baskets across countries. This makes it comparable in the cross-country analysis. We employed a linear panel model for inflation with fixed effects as a basic model. This model was estimated via the within estimator. For inference, the clustered standard errors were used. The basic model has the following specification:

$$y_{i,t} = \alpha + \beta X_t + \theta_i + \varepsilon_{i,t}, \quad (1)$$

where $y_{i,t}$ is the HICP growth, α is a constant, β is a coefficient vector, x_t is the matrix of explanatory variables, θ_i is an individual effect, $\varepsilon_{i,t}$ is a random error.

Several global and local (at the euro area and the country level, respectively) explanatory variables were used in the model. We collected annual data from several sources, namely the ECB's database, Eurostat, the World Bank database, and the Federal Reserve database. The unbalanced panel spanned from 2010 to 2018 and included all the euro area economies (19 countries).

Global variables in the model are:

- Short-term interest rates (lagged Euro Overnight Index Average rate, EONIA), which reflect standard monetary policy;
- The ECB balance sheet (assets, YoY), which reflects non-standard monetary policy;
- Nominal effective euro, YoY (lagged by two periods);
- Crude oil price (Brent, YoY);

Local variables are:

- Retail trade turnover (except motor vehicles and motorcycles, YoY);
- Unemployment rate;
- General government budget surplus/deficit (% of GDP);
- General government debt (% of GDP);
- Trade openness measured by the sum of exports and imports as a percentage of GDP;
- Enterprises purchasing via computer networks (% of all enterprises);
- Individuals' online purchases (at least one purchase over the last twelve months, % of all individuals).

The e-commerce indicators restricted the overall sample from 2010, while the other indicators were available from earlier years. The e-commerce indicators were treated as exogenous, given they associated with e-commerce penetration and consumer preferences.

One of the potentially endogenous variables in the baseline specification above is standard monetary policy instruments reflected by EONIA (the ECB reacts to the inflation dynamics, setting the level of short-term interest rates). EONIA directly depends on the monetary policy stance, more accurately reflecting the situation in the banking sector than the main refinancing operation rate. Another potentially endogenous indicator could be the ECB's assets, which reflect the non-standard monetary policy implemented by the ECB to improve the monetary policy transmission mechanism.

As an extension of the basic specification, a panel vector autoregression (PVAR) model was used, which was described in recent papers [10]. This model incorporates interaction among endogenous variables and may give an economic interpretation regarding efficiency of a monetary policy. However, the model requires more observations for the estimation and accurate inference.

The PVAR model in this paper has the following specification:

$$y_{i,t} = \alpha + \sum_{m=1}^{k} B_m y_{i,t-m} + CX_{i,t} + \delta_i + \varepsilon_{i,t}, \quad (2)$$

where $y_{i,t}$ are local and global endogenous variables, $x_{i,t}$ are exogeneous variables, α is a global constant, δ_i reflects fixed effects, B_m and C are coefficient matrices, while $\varepsilon_{i,t}$ are random shocks.

We conducted the estimation via the generalized method of moments. Nominal effective exchange rate dynamics and population e-commerce indicators were treated as exogenous variables in the model, while the HICP growth and EONIA were set endogenous.

The response to monetary policy shocks is the point of interest, while the effect of e-commerce could be inferred from the coefficient estimates. The orthogonalized impulse responses were used to calculate the response from monetary shocks.

Results

In contrast with our hypothesis, an initial cross-country analysis showed a weak positive relationship between e-commerce and inflation over the last five years (Fig. 1). This could be attributable to other country-specific factors, affecting inflation.

The largest share of online purchases among individuals was in the Netherlands, Luxemburg, and Germany. The share of online-buyers in the euro area was below 60% on average.

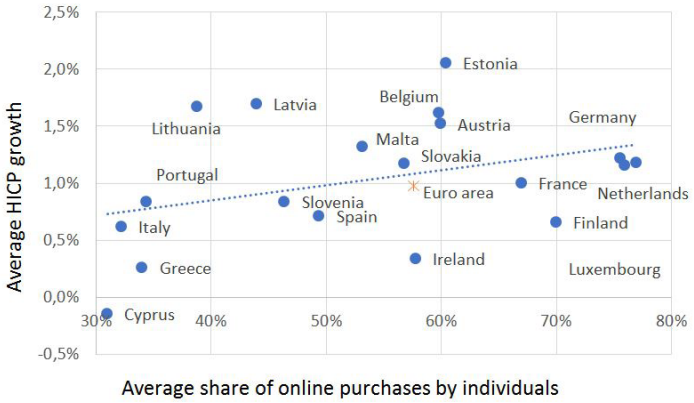

Figure 1. Inflation and online purchasing indicators as a percentage of all in the euro area (2015–2019)

Source: ECB, Eurostat, authors' estimates

However, the chart below (Fig. 2) illustrates a rather negative relationship between inflation and indicators of online purchases for individuals and enterprises over time. The inflation dynamics were sluggish in 2015–2019 (about 1% on average) amid an increasing percentage of online purchases. This may indicate that the upward trend of e-commerce development suppressed inflation dynamics.

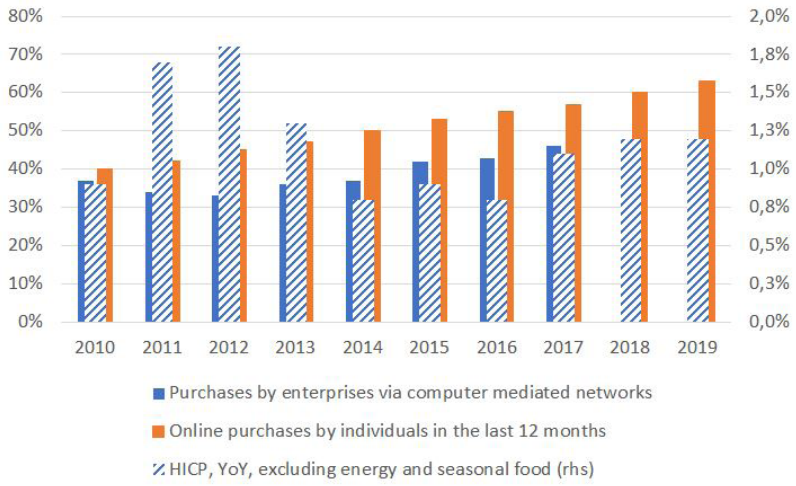

Figure 2. Inflation and online purchasing indicators as a percentage of all enterprises and individuals in the euro area

Note: the last available data on enterprises was for 2017.

Source: ECB, Eurostat

The panel model allows for exploring the cross-country impact of e-commerce in more detail. Table 1 illustrates the results of the baseline linear panel model estimation with fixed effects. Fixed effects were used based on the Hausman test results.

Several specifications were used to obtain robust estimates. In all the specifications EONIA, Brent, e-commerce for individuals, and the ECB assets (YoY) were significant. Given the three specifications, the coefficients are generally in line with economic intuition. Among inflationary factors are Brent price growth, the ECB's asset growth, and retail sales growth. Other factors showed a disinflationary effect. The EONIA rate demonstrated a disinflationary impact as a standard monetary policy instrument. Most importantly, both e-commerce variables showed a disinflationary effect, which was in line with the main hypothesis of this paper.

Table 1. The estimation results of the baseline linear panel model (three specifications with different sets of variables)

	(1)		(2)		(3)	
	HICP growth		HICP growth		HICP growth	
ECB assets, YoY	0.016	***	0.016	***	0.016	***
	(0.003)		(0.003)		(0.003)	
EONIA (lagged)	-1.760	**	-2.012	***	-2.047	***
	(0.759)		(0.759)		(0.759)	
Brent, YoY	0.029	***	0.029	***	0.029	***
	(0.003)		(0.003)		(0.003)	
E-commerce, individual	-0.123	***	-0.125	***	-0.125	***
	(0.030)		(0.030)		(0.030)	
NEER, YoY (lagged)	-0.027		-0.030		-0.031	
	(0.025)		(0.025)		(0.025)	
Retail sales, YoY	0.014		0.008		0.009	
	(0.025)		(0.025)		(0.025)	
E-commerce, companies	-0.019		-0.021	*	-0.021	*
	(0.013)		(0.013)		(0.013)	
Unemployment	-0.159	*	-0.152	*	-0.155	*
	(0.080)		(0.080)		(0.080)	
Openness			-0.011		-0.010	
			(0.016)		(0.016)	
Debt			-0.003		-0.003	
			(0.020)		(0.020)	
Surplus/deficit					-0.007	
					(0.184)	
R-Squared	0.653		0.658		0.658	
Observations	153		153		153	

Note: positive gauge of NEER reflects appreciation.

* means 10% significance

** means 5% significance

*** means 1% significance

Clustered standard errors are in the parentheses.

Source: authors' estimates

To extend the baseline model, the PVAR model was estimated (Table 2). Since the data were scarce, the model was restricted by only one lag and a smaller set of variables. The EONIA and HICP growth were set endogenous, while the ECB asset growth, the e-commerce indicator for individuals, and NEER were treated as exogenous. Before the PVAR estimation, the local variables were tested for the unit root, applying the test proposed in [11]. HICP growth was stationary, while the population e-commerce indicator was not. This could be attributable to the e-commerce development trend as more and more technological innovations are introduced over time. However, the e-commerce development trend may eventually plateau or even reverse, for example, due to tighter regulation. IT regulation in the world could potentially become tighter and detrimental to e-commerce. The regulation policy of the IT sector was discussed in [15].

Moreover, trade relations could worsen. For example, potential trade conflicts between large economies, such as the USA or China, may lead to commerce deteriorating. Such a threat became feasible in 2018–2019

when the US and China considered and imposed tariffs on trade flows between each other. Therefore, the nature of the e-commerce development trend is probably not truly time-dependent.

Finally, the e-commerce development trend has a natural cap of 100%. At the moment, several countries exhibited the share of online purchases below 50%. After reaching the levels closer to 100%, the potential for further e-commerce development will likely be exhausted. Therefore, disinflationary pressure from it can stop.

The impact of the e-commerce indicator on inflation was negative. This generally supports the main hypothesis of this paper.

Table 2. PVAR estimation results

	EONIA		HICP, YoY	
Lagged EONIA	0.547	*	-0.2458	
	(0.255)		(0.312)	
Lagged HICP, YoY	-0.099		0.3907	**
	(0.122)		(0.122)	
ECB assets, YoY	-0.0009		0.0337	***
	(0.007)		(0.010)	
E-commerce, individuals	-0.0441	*	-0.0492	
	(0.017)		(0.026)	
Lagged NEER, YoY	-0.0025		-0.091	**
	(0.084)		(0.035)	

Note: positive gauge of NEER reflects appreciation.

* means 10% significance

** means 5% significance

*** means 1% significance

Standard errors are in the parentheses.

Source: authors' estimates

The impulse response from the standard monetary shock (Fig. 3) was negative, in line with the economic sense. The model was compared with the same model without the e-commerce variable. Factoring the digitalization of commerce reduced the overall impact of unexpected monetary policy shock. Meanwhile, the shock itself was not significant.

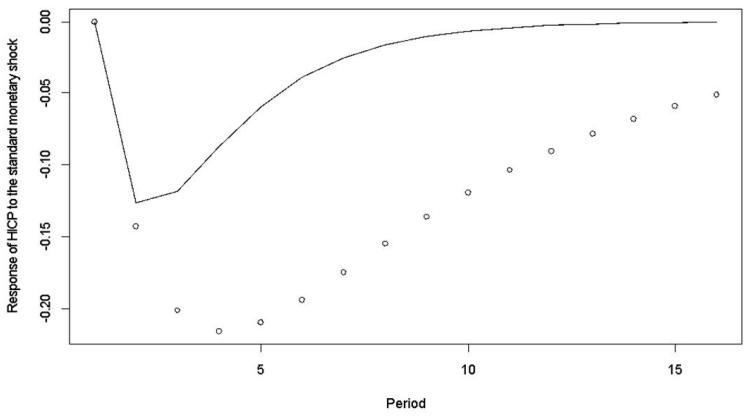

Figure 3. Orthogonalized impulse response from the standard monetary policy shock to HICP with the e-commerce variable (line) and without the e-commerce variable (dotted line)

Source: authors' estimates

Based on the PVAR model with endogenous ECB asset growth the shock of non-standard monetary policy was positive as expected. This means that non-standard measures boost inflation. However, similar to the standard policy, the shock was not significant.

To extend the analysis we can factor out the trend from the e-commerce indicator by taking the first difference of the respective indicator. This operation suppressed the significance of the coefficients in the baseline model.

In closing, there are several main results:

1) A preliminary statistical analysis showed an upward trend of e-commerce proxy (a share of online purchases among individuals and a share of purchases by enterprises via a computer network) in 2014–2018. This is a new result, revealing the current e-commerce development trend.

2) A panel analysis showed a statistically significant negative impact of a share of e-commerce on inflation (an increase of the share of online purchases by 1% leads to about -0.12% to -0.13% impact on inflation, while an increase of a share of purchases by enterprises via a computer network by 1% produced only -0.02% impact on inflation). This result confirms previous studies, such as [3], but also provides an important insight into the impact of e-commerce usage among companies. The latter was not extensively covered in related literature.

3) A PVAR model demonstrated insignificant results for an e-commerce development proxy;

4) An impulse response demonstrated a smaller magnitude of the standard monetary policy impact after considering an e-commerce variable. This implies a lower efficiency of monetary policy in the euro area. This issue is new and important and it reveals policy insight for decision-makers.

Further studies may relate to the underlying mechanism of disinflation. The analysis could be based on macro indicators, such as labor costs or unemployment, or on micro indicators of several particular companies.

The next step could be an analysis of spillovers from digitalization and e-commerce development, which may spread to other countries and regions. Considering the global value chain [16], the global disinflation trend may persist. The heterogeneity of the euro area can play an important role in its inflation dynamics, especially with regard to its unconventional monetary policy. The related issues were studied in [17–21]. Finally, the impact evaluation of IT regulation on digitalization will also extend this article.

Conclusion

The impact of e-commerce on inflation estimated to be *generally disinflationary* based on a sample of the euro area countries in 2010–2018 for both individuals and companies. This is new and important results for economic policy. However, this was likely attributable to the positive trend of e-commerce development rather than purely cross-country e-commerce development characteristics. This trend may eventually plateau as a result of stricter regulation of the IT sector or external trade deterioration. Currently, many countries exhibited the development of e-commerce far below the potential 100%. However, should this cap be reached, the disinflationary pressure from the e-commerce development will fade. Should the e-commerce development trend stop, we would observe the possible acceleration of inflation in the euro area. On the other hand, e-commerce development in other countries may produce disinflationary spillovers, contributing to global disinflation. From the theoretical point of view, the panel analysis based on the linear model with fixed effects and panel VAR model supports the hypothesis of the disinflationary impact of e-commerce development. This result may be useful for decision-makers and economic policy evaluation.

The analysis of monetary shocks revealed the efficiency of the standard monetary policy instruments, factoring the e-commerce development effect. Meanwhile, the results for the non-standard monetary policy shocks were positive. However, the estimates were insignificant.

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TOOL FOR ASSESSING THE LEVEL OF ENERGY SECURITY OF THE DECENTRALIZED POWER SUPPLY SYSTEM FOR ENTERPRISES IN CAMEROON

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The development of the energy system in Cameroon is linked to the electricity supply and demand market. In recent years, the place of development of small and medium-size enterprises has began to have a significant impact on the balance of consumption. The choice of a specific scheme for the operation of a decentralized electricity supply system for enterprises in Cameroon should be based on objective criteria. Depending on the goals of the enterprise, this criterion can be the cost of implementing the project, discounted cash income, profitability growth with a predetermined forecast horizon, and many others. The choice of this criterion is associated with a multi – factor analysis of the goals of the enterprise and the specifics of its functioning, and the set of possible variations of this criterion can be conditionally designated as "Economic criteria". The article presents a tool for determining a comprehensive criterion for assessing the level of energy security of the decentralized power supply system for small and medium-sized businesses in Cameroon. The tasks solved in the framework of the study allow us to develop a system of economic management tools in energy systems. This tool can be widely used in the development of decentralized electricity supply for small and medium-sized businesses that are experiencing problems with the reliability of electricity supply. This will eventually create a more sustainable system for developing this sector of the economy.A characteristic feature of determining the key economic indicator is the dependence on the energy supply system. In one case it can only be revenue, in the second case it can be profitability and revenue, and in the third case profit, revenue and profitability. Perhaps a similar tool can be developed for the energy supply systems of enterprises in other countries.

Keywords: energy security, economic criteria, decentralized power supply system, integrated analysis, small and medium- sized enterprises, integrated assessment tool, fuzzy set theory

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ИНСТРУМЕНТАРИЙ ОЦЕНКИ УРОВНЯ ЭНЕРГЕТИЧЕСКОЙ БЕЗОПАСНОСТИ СИСТЕМЫ ДЕЦЕНТРАЛИЗОВАННОГО ЭЛЕКТРОСНАБЖЕНИЯ ПРЕДПРИЯТИЙ КАМЕРУНА

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Развитие энергосистемы Камеруна зависит от рынка спроса и предложения на электроэнергию. В последние годы существенное влияние на баланс потребления начинает оказывать малый и средний бизнес. Выбор конкретной схемы функционирования децентрализованной системы электроснабжения предприятий Камеруна должен производиться на основе объективного критерия. В зависимости от целей предприятия данным критерием могут выступать затраты на реализацию проекта, дисконтированный денежный доход, прирост рентабельности с

заданным горизонтом прогнозирования и др. Выбор критерия сопряжен с многофакторным анализом целей предприятия и специфики его функционирования, а совокупность возможных вариаций данного критерия можно условно обозначить как «экономические критерии». В статье представлена методика определения комплексного критерия оценки уровня энергетической безопасности системы децентрализованного электроснабжения предприятий малого и среднего бизнеса Камеруна. Взвешенная сравнительная оценка уровня энергетической безопасности не может производиться на основе классических методов оценки. В первую очередь, это обусловлено необходимостью использования как статистических, так и экспертных показателей, выделенных в описанной системе. Следовательно, одним из наиболее подходящих для построения методики оценки уровня энергетической безопасности является нечетко-множественный подход. Данная методика должна базироваться на системе экспертных оценок, однако, в отличии от статистических и экспертных методов оценки, она дает возможность учитывать уровень неопределённости посредством использования функций принадлежности ($\mu(x)\in[0;1]$) подмножества заданному множеству. Решенные в рамках исследования задачи позволяют развить систему экономических инструментов управления в энергетических системах. Данная методика может получить широкое применение в системе развития децентрализованного электроснабжения предприятий малого и среднего бизнеса, испытывающих проблему с надежностью электроснабжения. В конечном итоге это позволит создать более устойчивую систему развития данного сектора экономики. Возможно, аналогичным методом может быть разработана методика и для систем энергоснабжения предприятий в других странах.

Ключевые слова: энергетическая безопасность, экономические критерии, децентрализованная система электроснабжения, комплексный анализ, малые и средние предприятия, методика комплексной оценки, теория нечетких множеств

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Introduction

Cameroon is currently destabilized in terms of many aspects of business infrastructure. The result of this destabilization is an increase in the consequences of the implementation of possible risks, and, consequently, a significant increase in the probability of suspension or complete termination of the company's activities. Thus, the energy security of the scheme of functioning of the decentralized power supply system (DPSS) of enterprises is no less significant than the economic effect of its implementation. However, at the moment, there is no universal criterion of energy security (ES) developed in science. This fact is due to the fact that the specified criterion is complex and is determined by a set of many factors, significantly differentiated depending on the object of research [2].

Purpose of research: development of a tool for a comprehensive assessment of the level of energy security of a decentralized power supply system.

Object of research: decentralized power supply system for small and medium-sized enterprises in Cameroon, experiencing problems of unreliability or complete absence of a centralized power supply system.

Subject of research: energy security of possible schemes for managing energy supply to enterprises.

Tasks:

1. Identify the main factors, determining the energy security of small and medium-sized businesses in Cameroon;
2. Based on the identified factors, propose a set of indicators for assessing the energy security of small and medium-sized businesses in Cameroon;
3. Develop a tool for determining the values and units of measurement of the proposed indicators;
4. Based on the theory of fuzzy sets to build a tool for assessing the level of energy security of the enterprise.

Research methods

For the purpose of developing the tool for assessing, first of all, it is necessary to determine the factors that influence the ES of the implementation of the scheme of functioning of the DPSS of enterprises in Cameroon. A complex analysis allowed us to identify the following macro factors that affect the ES of energy supply systems of enterprises in Cameroon:

1. *The scale of the company's activities*. This factor determines the possibility of exclusively independent energy generation [2]. In the absence of this possibility, the company is forced to cooperate with other enterprises in the region, which significantly reduces the level of ES, due to the increment in the system of potentially uncontrolled subjects of management decision-making. The influence of this factor can be expressed by the following indicators:

1.1. *The Ratio of the company's annual revenue to the cost of implementing the project to build a DPSS*. This indicator reflects the ability to independently ensure the implementation of the project. The vector of impact on ES is positive. Reference designation is – $I_{1.1}$. The units of measurement are *percentages*.

1.2. *The Ratio of the average annual volume of working capital of the enterprise to the average annual cost of ensuring the operation of the proposed power supply system*. The mechanism of influence of this indicator is comparable to the previous one. Vector of impact on energy security is positive. Reference designation is – $I_{1.2}$. The units of measurement are *percentages*.

2. *The business sector of the company*. This factor primarily determines the possibility of independent production of fuel, which is the main energy carrier in the framework of the considered energy supply system of the enterprise [4]. Also, this factor reflects the specifics of energy consumption. The influence of this factor can be expressed by the following indicators:

2.1. *The Proportion of required fuel provided at the expense of productive activities*. This indicator reflects the ability to independently provide the power supply system with the necessary amount of energy. The vector of impact on ES is positive. Reference designation is – $I_{2.1}$. The units of measurement are *percentages*.

2.2. *The ratio of the energy intensity of the main production processes to auxiliary ones*. This indicator reflects the conditional risk of stopping production activities as a result of accidents and breakdowns of the proposed power supply system [4]. The decrease in this indicator determines the increment of the possibility of redistributing energy capacity and, as a result, ensuring the stability of the main production processes. The vector of impact on ES is negative. . Reference designation is – $I_{2.2}$. The units of measurement are *percentages*.

3. *Geographical location of the company*. Since Cameroon is geographically heterogeneous in terms of distribution of energy resources, as well as in terms of urbanization, the influence of this factor cannot be ignored [15]. The influence of this factor can be expressed by the following indicators:

3.1. *The average distance to energy resources*. This indicator determines the ability to meet the company's demand for raw materials needed for energy generation in a timely and sufficient manner. The vector of impact on ES is negative. Reference designation is – $I_{3.1}$. The unit of measurement is kilometers.

3.2. *Conditional transport availability of energy resources*. This indicator is an expert indicator and determines the labor intensity of delivery of raw materials needed for energy generation. The vector of impact on ES is positive. Reference designation is – $I_{3.2}$. Units of measurement are points.

4. *Climate influence*. This factor reflects the influence of climatic conditions in the region of operation of the enterprise on the process of generating energy in the power supply system. The influence of this factor can be expressed by the following indicators:

4.1. *Conditional index of the influence of the environment*. This indicator is expert and reflects the level of aggressiveness of the region's environment in relation to the energy generation process within the proposed energy supply system. The vector of impact on ES is negative. Reference designation is – $I_{4.1}$. Units of measurement are points.

5. *The status of the regional networks*. This factor reflects the stability of regional networks and the dependence of the enterprise on this conditional value [14]. The influence of this factor can be expressed by the following indicators:

5.1. *The Ratio of the time of power failure due to accidents to the calendar time for the previous year*. This indicator reflects the stability of the energy distribution system. The vector of impact on ES is negative. Reference designation is – $I_{5.1}$. The units of measurement are *percentages*.

5.2. *Wear coefficient of the regional energy distribution system*. This indicator reflects the projected period of increasing risk of reducing the stability of the energy distribution system. The vector of impact on ES is negative. Reference designation is – $I_{5.2}$. The units of measurement are *percentages*.

5.3. *Conditional index of the company's dependence on the regional energy distribution system*. This indicator is an expert indicator [12]. The vector of impact on ES is negative. Reference designation is – $I_{5.3}$. Units of measurement are points.

6. *Environmental legislation*. This factor is the most complex, and reflects the specifics of the legitimization of the project under study and the level of state support for the chosen method of energy generation. The influence of this factor can be expressed by the following indicators:

6.1. *Conditional index of regulatory voltage*. This indicator is expert and reflects the complexity of legitimizing the proposed energy supply system. The vector of impact on ES is negative. Reference designation is – $I_{6.1}$. Units of measurement are points.

The presented system of indicators is multidimensional, primarily from the point of view of the studied consequences [2]. The strength of the influence of the considered indicators on the possible result is expressed by the specific gravity which can be distributed evenly, at the primary level (Fig. 1).

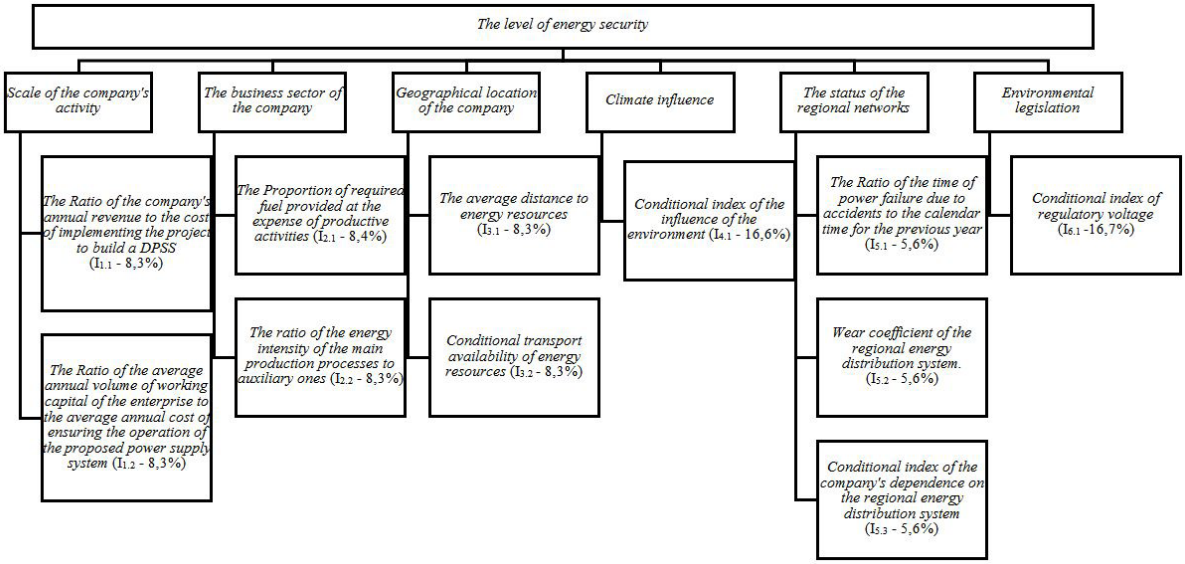

Figure 1. Distribution of specific weight of indicators

A weighted comparative assessment of the level of energy security cannot be made on the basis of classical tools. First of all, this is due to the need to use both statistical and expert indicators identified in the described system. At the same time, the complexity of the research object determines the need to allocate fuzzy evaluation intervals that allow describing the degree of confidence of the expert in the conclusions made. Therefore, one of the most suitable tool for assessing the level of energy security is the fuzzy multiple approach. This tool should be based on a system of expert assessments, however, in contrast to statistical and expert assessment tools; it makes it possible to take into account the level of uncertainty by using the functions of belonging ($\mu(x) \in [0;1]$) of a subset to a given set. The founder of applying the theory of fuzzy sets to describe economic processes is doctor of Economics Nedosekin A. O. In the framework of his doctoral dissertation "Methodological foundations of financial activity modeling using fuzzy multiple descriptions", the author offers an algorithm for evaluating a complex economic indicator using fuzzy set theory [1]. This algorithm is the basis for building a tool for assessing the level of ES.

Result of research

The algorithm of forming fuzzy multiple classifiers includes the definition of factors, identification of linguistic variables, the base term set, the definition of the carrier of linguistic variables, and the calculation of partial and integral indicators.

Within the framework of the tool, 1 integral linguistic variable is identified "the Level of the energy security criterion of the energy supply system (I)". The base term set for this criterion has 2 subsets:

1. Unacceptable level of ES of the power supply system;
2. Acceptable level of ES of the power supply system.

This integral indicator is the resulting indicator of the tool. For each particular indicator, a linguistic variable is also formed «the value of a particular indicator (In.n). The base term set for these indicators has 5 subsets each:

1. Unacceptable value for indicator;
2. Low indicator value;
3. Average value of the indicator;
4. High indicator value;
5. Indicative value of the indicator.

The standard five-level 01-classifier is selected as a classifier for particular indicators. In the classifier, the segment of the real axis [0;1] (01-the carrier) acts as the carrier of the linguistic variable. To describe the type of subsets of a term set, a system of five membership functions is introduced that characterize the degree to which a segment of carrier values belongs to a given subset (Table 1).

Table1. System of fuzzy-multiple classifiers of particular indicators

Indicator	T- numbers {Y} for values of a linguistic variable				
	Unacceptable value for indicator	Low indicator value	Average value of the indicator	High indicator value	Indicative value of the indicator
$I_{1.1}$	(0.4; 0.4; 0.6; 0.8)	(0.6; 0.8; 1; 1.2)	(1; 1.2; 1.4; 1.6)	(1.4; 1.6; 1.8; 2)	(1.8; 2; +∞; +∞)
$I_{1.2}$	(2.5; 2.5; 3; 3.5)	(3; 3.5; 4; 4.5)	(4; 4.5; 5; 5.5)	(5; 5.5; 6; 6.5)	(6; 6.5; +∞; +∞)
$I_{2.1}$	(0; 0; 10; 20)	(10; 20; 30; 40)	(30; 40; 50; 60)	(50; 60; 70; 80)	(70; 80; 80; 80)
$I_{2.2}$	(100; 100; 100; 80)	(100; 80; 70; 60)	(70; 60; 50; 40)	(50; 40; 30; 20)	(30; 20; 10; 10)
$I_{3.1}$	(300; 300; 300; 275)	(300; 275; 250; 225)	(250; 225; 200; 175)	(200; 175; 150; 125)	(150; 125; 100; 0)
$I_{3.2}$	(1; 1; 2; 3)	(2; 3; 4; 5)	(4; 5; 6; 7)	(6; 7; 8; 10)	(8; 10; 10; 10)
$I_{4.1}$	(10; 10; 10; 8)	(10; 8; 7; 6)	(7; 6; 5; 4)	(5; 4; 3; 2)	(3; 2; 1; 1)
$I_{5.1}$	(+∞; +∞; 20; 17)	(20; 17; 14; 11)	(14; 11; 8; 5)	(8; 5; 3; 1)	(3; 1; 0; 0)
$I_{5.2}$	(100; 100; 100; 80)	(100; 80; 70; 60)	(70; 60; 50; 40)	(50; 40; 30; 20)	(30; 20; 10; 10)
$I_{5.3}$	(10; 10; 10; 8)	(10; 8; 7; 6)	(7; 6; 5; 4)	(5; 4; 3; 2)	(3; 2; 1; 1)
$I_{6.1}$	(10; 10; 10; 8)	(10; 8; 7; 6)	(7; 6; 5; 4)	(5; 4; 3; 2)	(3; 2; 1; 1)

These classifiers can be represented as trapezoidal membership functions, where the ordinate axis indicates the values of membership functions (from 0 to 1), and on the axis of the abscissas – terms. In this case, the upper base of the trapezoid corresponds to the expert's absolute confidence in the reliability of the classification, and the lower base characterizes the confidence that no other values of the interval (0;1) do not fall into the selected fuzzy subset. The side faces of the trapezoid reflect the fluctuation of the expert's judgment about the belonging of a particular segment on 01 – carrier to a particular term. There are 5 nodal points: {0,1; 0,3; 0,5; 0,7; 0,9}. Based on the results of calculating each of the particular indicators, their values are recognized by the criterion $\lambda ij \in [0;1]$. This indicator correlates the values of individual indicators with the values of 01 – carriers:

$$\lambda_{ij} = 1 - \frac{X_i - a_3^*}{a_4^* - a_3^*}$$

where a_3^* and a_4^* are the t-numbers of the I-th subset of the term set.

Based on the results of recognizing the values of particular indicators, integral indicators are calculated:

$$I = \sum_{1}^{10} p_j \times r_j \times \lambda_{ij} .$$

Where p_j are the node points of the 01 carrier:

$$p_j = 0{,}9 - 0{,}2 \times (j - 1) .$$

Where j is the number of subsets of the base term set.

The resulting integral indicator is recognized in accordance with two selected term sets, the boundary value:

1. Unacceptable level of energy security of the power supply system – (0; 0; 0.4; 0.8).
2. Acceptable level of energy security of the power supply system – (0.4; 0.8; 1; 1).

If the project under consideration does not reach the acceptable level of energy security, regardless of the size of the potential economic effect, it is rejected. Fig. 2 shows a comprehensive assessment of the level of energy security of the decentralized power supply system for enterprises in Cameroon.

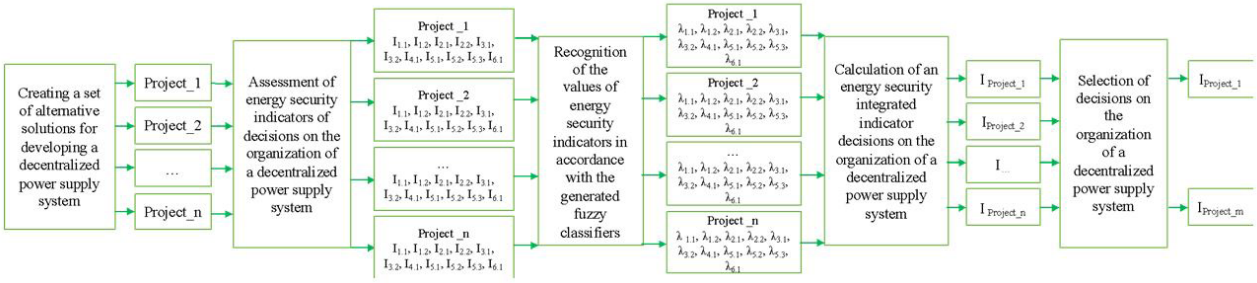

Figure 2. Tool of comprehensive assessment of the level of energy security of the decentralized power supply system (m < n)

Implementation of it will provide an additional tool for managing the development of the fuel and energy complex of the country as whole and individual regions with significant potential for using biofuels. Such an example can be the energy complex of Cameroon. The tool proposed by the author can be used to determine the energy supply management system and select the type of generating source from the point of view of providing a comprehensive solution to maximize energy security and minimize economic costs. The use of fuzzy set theory will increase the level of validity of the applied solutions.

Conclusions

The tasks solved in the framework of the study allow us to develop a system of economic management tools in energy systems. This tool can be widely used in the development of decentralized electricity supply for small and medium-sized businesses that are experiencing problems with the reliability of electricity supply. This will eventually create a more sustainable system for developing this sector of the economy. Perhaps a similar tool can be developed for the energy supply systems of enterprises in other countries.

The authors see the addition of the energy security criterion to the economic efficiency criterion as areas for further research. Consistent application of these criteria will allow for the final selection of the

management decision based on the selected indicators of economic efficiency based on the assessment of the energy security indicator. A characteristic feature of determining the key economic indicator is the dependence on the energy supply system. In one case it can only be revenue, in the second case it can be profitability and revenue, and in the third case profit, revenue and profitability.

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