Digital tools for managing the economic security of a depressed region

Michael Balog1, Alexander Babkin1, and Elena Shkarupeta1
1Pskov State University, 2 Lenin Square, Pskov, 180000, Russia

Abstract. This publication is a theoretical work which aims at exploring the possibilities of using digital tools to manage the economic security of a depressed region. To achieve the stated aim, the following methods were used: analysis, synthesis, abstraction, systematization and structuring of information. We also used integrated, comparative, functional and cause-and-effect methods. The object of this publication is a depressed region. The subject of the study is digital tools that can be used to manage economic security at the regional level. The study showed that one of the key threats to the economic security of a depressed region is the consistently low values of indicators of social and economic development. It was determined that the use of digital tools can improve the condition of a depressed region in the following areas: the formation of high-quality human capital; development of remote employment in a depressed region; creation of new jobs in a depressed region; digitalization of clusters to increase the competitiveness of companies in a depressed region; creation of a digital ecosystem for managing the economic security of a depressed region.

1 Introduction

In the scientific literature there is no common understanding of the essence of a depressed region. Based on the analyzed definitions of the concept of a depressed region, we can distinguish dynamic, static and comprehensive approaches to its understanding. If in the dynamic approach the emphasis is on the deterioration of the economic results of the territory, then in the static approach the focus is on the impossibility of the region emerging from the current situation of economic decline on its own. The integrated approach, in turn, combines the ideas of dynamic and static approaches.

The dynamic approach assumes a deterioration in the values of the region’s economic indicators in comparison with its own results of past years or in comparison with the indicators of other regions in the present time. Thus, territories that, as a result of the transition from an administrative-command to a market economy and during the subsequent formation of the latter, have seriously deteriorated their once high economic indicators in various sectors, primarily in industry, are considered depressed [1]. This interpretation reveals the historical reasons for depression as a stable characteristic of certain territories, but does not provide an answer to the reasons for the persistence of this characteristic in the
present. Within the framework of the dynamic approach, depressed regions also include territories with economic development indicators below the Russian average [2]. The disadvantages of this definition include the inability to explain the causes of depression in the regions, as well as the low-threshold criterion that forces a significant part of the constituent entities of the Russian Federation to be categorized as depressed. According to this point of view, even if a region demonstrates stable positive dynamics, but has not yet reached the average Russian indicators of economic development, it will need to be classified as depressed, which is a rather controversial decision. It is important to note that the dynamic approach as a whole has a high cognitive potential, which allows one to correctly determine the criteria for classifying a particular region as a depressed one.

According to the static approach, depressed regions are characterized by their inability to independently overcome the current crisis situation. In particular, there is a lack of incentives for their own development due to the current economic, political, social and other unfavorable circumstances [3]. This approach seems promising from the point of view of explaining the current reasons for a particular territory being in the status of a depressed region. Such reasons may include an institutional environment unfavorable for the development of entrepreneurship, weak innovative and digital potential of the territory, underdeveloped financial infrastructure, low standard of living of the population, etc.

Based on the synthesis of dynamic and static approaches, we can propose a comprehensive approach to determining the essence of depressed regions, according to which these are the territories: 1) not capable of independent transition to the stage of economic growth; 2) having low values of indicators of social and economic development over a long period of time. This approach includes the strengths characteristic of dynamic and static approaches. An integrated approach can be successfully used in scientific research, provided that the threshold of depression in the region is correctly determined.

Speaking about depressed regions and the possibility of their overcoming the current state, it is necessary to pay attention to digitalization, which is the main trend in the development of all spheres of public life in recent decades and for the foreseeable future. The large-scale introduction of digital technologies has contributed to increasing the competitiveness of companies by reducing costs, minimizing spatial barriers, increasing labor productivity, and increasing the speed and quality of management processes. Such tangible benefits from business digitalization served as the basis for the formation of digital business models and the digital economy. Depressed territories can take advantage of existing digital tools to transform their local economies, taking into account the requirements of the time, in order to provide transition to sustainable development.

The object of this publication is a depressed region. The subject of the study is digital tools that can be used to manage economic security at the regional level.

2 Materials and Methods

3 Results and discussion
determined that the use of digital tools can improve the state of economic security of a depressed region in areas related to the formation and use of human capital, the economic base of the region and the regional management system, as shown in Figure 1.

Before proceeding to a detailed consideration of the use of digital tools in managing the economic security of a depressed region, it is necessary to understand the factors that contribute to the development of digital technologies at the regional level. Numerous studies in this area presented in the scientific literature can be divided into two categories:

1) composite indices of digital development (or readiness for digital development) of various objects (enterprises, industries, regions and countries);

2) statistical studies using econometric methods to identify relationships between certain indicators of digitalization and socio-economic indicators of regions in which digital technologies were used [4].

Decomposition of complex indices of digital economic development allows us to identify three groups of digitalization factors, namely factors of development, use and impact of digital technologies, presented in Table 1.

Table 1. Digitalization factors based on digital development indices. Source: compiled by the authors from [4, 24]

<table>
<thead>
<tr>
<th>Development factors</th>
<th>Usage Factors</th>
<th>Impact factors</th>
</tr>
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<tbody>
<tr>
<td>Political and regulatory environment</td>
<td>Use in business processes</td>
<td>Economic effects (increasing the competitiveness of companies, the emergence of new business models, ensuring economic growth)</td>
</tr>
<tr>
<td>Business climate</td>
<td>Household use of digital technologies</td>
<td>Social effects (increased quality of life, contribution to achieving sustainable development goals, ensuring trust, regulation and inclusion)</td>
</tr>
<tr>
<td>Innovative environment</td>
<td>Use in state and municipal administration</td>
<td>-</td>
</tr>
<tr>
<td>Digital infrastructure and digital content</td>
<td>Application in healthcare</td>
<td>-</td>
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<tr>
<td>Technical, economic and competency accessibility of digital technologies</td>
<td>Application in education</td>
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Development factors provide the necessary conditions for the possibility of introducing digital technologies into the regional economy. Usage factors shape the demand for digital technologies from various economic entities. Impact factors contribute to digitalization
processes through actually achieved or even expected economic and social effects that motivate companies and authorities to implement digital solutions.

Turning to statistical studies, it can be noted that the strongest relationship with the development of digital technologies was demonstrated by the following regional socio-economic factors and indicators:

- Investment climate, economic conditions, human capital and scientific potential [4];
- GRP per capita, share of employed people with higher education [5];
- The ratio of the cost of mobile communication and Internet services per month in relation to the average monthly salary, the share of household expenses on food in the total structure of expenses [6].

3.1 Formation of high-quality human capital in a depressed region

The introduction of distance learning using specialized digital platforms can reduce the impact of territorial barriers between participants in the educational process. Artificial intelligence technologies are capable of forming and adjusting a personalized learning path based on the student’s needs and capabilities, generating educational tasks and checking them. Big Data technologies are capable of processing large amounts of data that educational organizations can use not only in the educational process and implementation of scientific projects, but also in the management of the organization itself [7]. Massive open online courses provide opportunities to popularize knowledge among a wide audience of students, and are also a marketing strategy of universities aimed at expanding the market for educational services [8]. Using the example of European countries, it is shown that digital hubs contribute to the development of rural areas through the formation of in-demand knowledge and skills in individuals, as well as the development of digital literacy, e-commerce and business mentoring [9]. At the same time, it is necessary to take into account the ambiguity of the influence of digital technologies on the process of human capital formation. Digital technologies in education often lead to an increased burden on teachers and students, decreased motivation due to the lack of presence, distortion of information during its remote transmission, and a decrease in the level of students’ training due to the lack of need to remember and take notes on information available online 24 hours a day [10].

It is noted that an influential factor encouraging the population to improve their digital competencies is the high demand of employers for specialists with knowledge and skills in the field of information and communication technologies [11]. Thus, the formation of highly effective human capital closely depends on the demand for it from various organizations. This relationship can pose a serious problem for depressed regions experiencing a shortage of high-tech jobs. However, digital tools provide an opportunity to overcome this difficulty through distance employment, creating new jobs in the field of information and communication technologies and related industries, increasing the competitiveness of organizations operating in the region by introducing digital technologies into their business processes.

3.2 Development of remote employment in a depressed region

Under the circumstances of the shortage of jobs in their own region, representatives of many professions, primarily in the field of information and communication technologies, can work in a completely remote format. State policy in the field of digitalization helps to increase the number of such specialists. According to the Federal Project of the Russian Federation “Personnel for the Digital Economy”, by 2024 it is planned to accept about 500
It should be noted that remote work opportunities are also available for professions not related to the information and communication technology sector. Customer service managers, teachers, translators, as well as representatives of many other professions are able to do their work remotely, provided they have the necessary digital competencies. In addition, numerous digital platforms (payment services, marketplace, order aggregators) are able to provide income for enterprising people who prefer to be completely self-employed or find an additional source of income.

It should be noted that the development of remote employment is often accompanied by a reduction in the period of employee interaction with a specific employer, attracting specialists to perform a specific project. In these conditions, in order to maintain their own competitiveness, employees need to acquire new competencies and regularly develop them. In addition to professional skills, digital, communicative, legal, financial and entrepreneurial competencies acquire value. In conditions of remote employment, it is necessary to be able to find projects that deserve attention, conclude contracts for their implementation on favorable terms, protect their interests in the legal field and manage their finances rationally (the latter becomes especially important in case of long breaks between projects). Self-discipline, self-learning ability, emotional literacy, cross-cultural and creativity are also important.

At the same time, considering the impact of distance employment on the economic security of a depressed region in accordance with a systematic approach, it is necessary to note the ambiguity of this phenomenon. If the population gets new employment opportunities, then organizations may lose the most competitive personnel in the region. Remote employment can contribute to labor migration in the digital space, i.e. maintaining the former place of residence, but at the same time getting a job in another region or even a country using remote technologies.

3.3 Creation of new jobs in the depressed region

It is assumed that the introduction of digital technologies by companies contributes to the growth of labor productivity, and, consequently, to an increase in wages. Digitalization also helps to reduce production, logistics, transportation, management and marketing costs. All this leads to an increase in demand for local products, which means an increase in demand for labor, stimulating the creation of new professions and industries. First of all, the growth in demand for workers affects the information and communication technology sector and related sectors of the economy. The study carried out on the basis of statistical data from Spain showed that an increase in investment in information and communication technologies by 1% in all sectors of the economy will cause an increase in total employment by 0.02% and an increase in real wages by 0.01%.

Speaking about the impact of digitalization on the overall level of employment, it should also be noted that there is an opposite point of view in the research environment, suggesting a reduction in demand for labor. In particular, it is noted that the development of robotics and artificial intelligence technologies make an increasing number of professions open to automation. In turn, the reduction in the cost of implementing digital tools motivates enterprises to replace labor with capital.

The study conducted on the data from the US labor market revealed that the introduction of one additional industrial robot per thousand employees reduces employment by 0.2%, and reduces wages by 0.42%.

The logic of theoretical arguments, as well as the validity of the conclusions of empirical works demonstrating the correctness of a particular point of view lead to the idea that the impact of digitalization on the level of employment is ambiguous and depends on the object under study. The studies presented in the scientific literature based on statistical data suggest that the increase in investment in information and communication technologies leads to an increase in employment, while the introduction of robotics and artificial intelligence technologies leads to a decrease in employment. However, these studies are based on data from different countries and industries, and the results may differ depending on the specific conditions.

In conclusion, it can be said that the impact of digitalization on the level of employment is ambiguous and depends on the specific conditions and circumstances. It is necessary to conduct further research and analysis to better understand the impact of digitalization on the labor market and to develop effective strategies for managing the transition to a digital economy.
3.4 Digitalization of clusters to increase the competitiveness of companies in a depressed region

Territorial-sectoral and intraregional clusters are an important tool for managing the economic security of a depressed region. Territorial-industrial clusters are associations of production, transport, consulting, scientific, educational and other organizations that provide a full set of operations from product development to delivery to the consumer. To ensure economic efficiency, the territorial proximity of the participants of these associations which at the same time may be located in different subjects of the Federation is essential (2-3 hours on the way). The purpose of the formation of these structures is to increase the competitiveness of participating organizations by activating their joint investment and innovation activities. An important condition for the success of territorial-industrial clusters is a combination of cooperation and competition between their participants.

In turn, intraregional clusters are limited to the territorial limits of one entity of the Federation and include all municipalities of the region. These associations do not form a complete value-added chain (therefore, strictly speaking, they are quasi-clusters), however, due to intraregional ties and complementarity of participants, they ensure the formation and development of points of economic growth [18]. We believe that intraregional clusters can solve the problem of the weak positive impact of territorial-industrial clusters on the economy of a depressed region. As practice shows, a successful cluster formed on a certain territory on an industry basis contributes to the development of the municipality in which it itself is located. However, other municipalities do not receive a significant positive effect. This situation leads to a serious economic differentiation between municipalities, because territorial-industrial clusters are usually located in the most economically developed areas [19]. Thus, the supplementation of territorial-sectoral clusters with intraregional clusters will contribute to the development of cooperative ties between industry leaders on the one hand and small and medium-sized enterprises located in the same entity of the Federation, on the other hand.

Digital technologies reduce the impact of geographical restrictions and reduce the transaction costs of participants' interaction. Due to the obvious benefits, the process of digitalization of the economy transforms the mechanisms of organizational interaction of business structures, which fully concerns clusters. The inherent problem of digitalization of a large and at the same time constantly increasing amount of data pushes companies to cooperate by creating joint platform solutions. Joint digital platforms solve the tasks of quickly providing up-to-date and personalized information for consumers; carry out the formation and analysis of the data arrays received from consumers that are available to all cluster participants; ensure the interaction of participants within the framework of joint process and project activities; provide opportunities for creating digital counterparts of products and processes in order to optimize them; provide support for decision-making in management business processes [20, 21].
3.5 Creating a digital ecosystem for managing the economic security of a depressed region

The ecosystem will allow to receive a large amount of data in real time, as well as process them quickly and efficiently in order to monitor the state of the economy of the region. This will improve the quality of management decisions made at the regional level, as well as reduce the response time to neutralize challenges and threats to economic security.

It is assumed that the ecosystem of economic security management in a depressed region should include analytical and management levels presented at Figure 2.

The analytical level of the ecosystem, using Blockchain and Big Data technologies, will collect and store information from various types of sources: Internet of Things (IoT) sensors, statistical data, information from social networks and mass media, open company data. Based on the information received, artificial intelligence technologies will compile metrics and identify threats to the economic security of a depressed region. The technology of digital twins will allow predicting the dynamics of various processes, objects and threats to the economic security of a depressed region. This information can be accessed by the representatives of civil society through mobile applications and online access to the relevant website. Such openness will help to increase the effectiveness of regional government bodies and increase public confidence in them.

Fig. 2. Digital ecosystem of economic security management in a depressed region: compiled by the author from [22, 23].

The management level of the ecosystem is designed to implement measures to counter threats to the economic security of a depressed region. Its functionality includes making recommendations to executive authorities using machine learning and a decision support system (DSS) to neutralize threats to economic security. Within this level, control over the Management level - Automatic adjustment based on data from Internet of Things (IoT) devices - Drawing up recommendations for authorities using machine learning and DSS to neutralize threats to economic security - Control over the execution of management decisions by means of IoT sensors and other sources - The use of explicable AI for control by citizens

Analytical level - Collection and storage of information based on Blockchain and Big Data technologies - Compilation of metrics and identification of threats to economic security using artificial intelligence (AI) - Forecasting the dynamics of processes, objects and threats to economic security using digital twins technology - Control by citizens using mobile applications and online access

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Execution of management decisions is also carried out using information coming into the ecosystem from various types of sources. Significant opportunities for optimizing various processes in the infrastructure of a depressed region are provided by their automatic correction with the help of Internet of Things (IoT) sensors, digital twins and artificial intelligence technologies. It is also preferable to make management decisions made at this level open to representatives of civil society. For this purpose, it is proposed to use Explicable artificial intelligence. The purpose of this technology is to provide a person with information that allows to understand how computer algorithms make a particular decision.

It can be expected that the introduction of a digital ecosystem of economic security management in a depressed region will have the following effects:

- increasing the speed and quality of management decision-making through the use of digital technologies;
- optimization of budget expenditures by reducing operational infrastructure costs;
- increase in the budget revenue due to tax revenues based on the results of the digital inventory of real estate;
- reduction of pollutants and waste emissions through optimization of construction works, traffic management, city services, etc.

To work effectively, the digital ecosystem of economic security management in a depressed region should be organically integrated into the system of executive authorities of this entity of the Federation. To do this, a body should be created in the executive power structure, the purpose of which will be to comprehensively ensure the work of the ecosystem from the preparation of data for machine learning to ensuring and coordinating the interaction of authorities and representatives of civil society in the digital environment.

4 Conclusions

In the course of the study, it was determined that one of the key threats to the economic security of a depressed region is the consistently low values of indicators of social and economic development. The use of such digital tools as blockchain, Big Data, the Internet of things, digital twins, machine learning, artificial vision, decision support systems, explicable artificial intelligence, mobile applications can improve the state of a depressed region in the following areas: the formation of high-quality human capital; development of remote employment in a depressed region; creation of new jobs in a depressed region; digitalization of clusters to increase the competitiveness of companies in a depressed region; creation of a digital ecosystem for managing economic security in a depressed region. However, it should be borne in mind that digital technologies are tools that require reasonable application. Otherwise, they can aggravate existing problems and cause serious damage to a depressed region, in particular, it concerns the loss of highly skilled labor and job cuts as a result of replacing human labor with a machine.

It should also be taken into account that, based on the limited capabilities of the depressed region, its digitalization will require the involvement of external resources. They can be provided by the state by implementing appropriate digital transformation programs and creating conditions for attracting innovation-active companies (for example, by creating special economic zones in depressed regions). It is also promising to use public-private partnership mechanisms for the digital transformation of depressed territories.

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