

Digital technologies in solving problems of innovative development of Russian regions

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Abstract — The era of digitalization sets new external challenges and creates new opportunities for the innovative development of territories. The European concept of “smart specialization”, considered in the authors' study, allows solving the problem of innovative development of Russian territories, taking into account the existing EU experience, since it relies on the assets and resources available to regions and states. Specialization of the region means focusing on its strengths and competitive advantages, as well as identifying real innovative growth potential and enhancing entrepreneurial activity. The methodology of the concept of “smart specialization” considered in the article allows to identify the possibilities and difficulties of its implementation in the Russian context. It also provides a rationale for the use of digital technologies in solving the problems of the innovative development of Russian regions. It is proposed to use the platform approach, as a tool of the digital economy, for information and communication support of the innovative strategic process in the regions.

Keywords — digital economy, platform approach, the concept of “smart specialization”, innovative development.

I. INTRODUCTION

Analysis of the innovative development of the Russian regions indicates their rather high differentiation [1,2,3]. Scientific centers and universities are distributed unevenly throughout the country, as well as innovative companies and clusters. Of course, the level of innovation activity of a particular region is largely determined by its potential and the historically established structure. However, this does not mean that the traditionally subsidized region does not have the opportunity to become technologically advanced. In addition to the prevailing conditions, a particular territory has its own comparative competitive advantages that distinguish regions from each other. The ability to correctly identify these hidden unique opportunities of the territory is the most important task of regional innovation policy. However, in domestic practice, there is no clear algorithm for choosing priority directions for the development of a region. Most often, priorities are chosen based on historical conditions (traditional for the region), or

from priorities identified at the federal level (for example, a list of critical technologies). The main problem in the first case is that most often there is no talk of innovation, in the second case, as a rule, the potential in the region is not taken into account, and the priority is chosen only because it is “fashionable”. In this regard, the search for its unique niche for a particular region is an urgent task that requires additional research.

Analysis of the international experience of regional innovation policy made it possible to emphasize the European concept of “smart specialization”, which is based on the search for unique comparative advantages for a particular territory. Given that the EU countries are among the leaders in terms of innovation development [4], their experience can rightly be regarded as effective.

II. THE ESSENCE AND CONTENT OF THE CONCEPT OF "SMART SPECIALIZATION"

The concept of “smart specialization” plays a key strategic role in the EU innovation policy and serves as a tool to achieve the goals of enhancing research, technological development and expanding opportunities for innovation activities, as well as creating free access to high-quality information and communication technologies and their use. Therefore, the functions of “smart specialization” in relation to solving problems of innovative development of territories can be represented as follows:

1) the concentration of knowledge resources for economic specialization (since the concept of “smart specialization” is based on the rational use of knowledge resources and their linkage with a limited number of priority economic activities, economic specialization will allow regions to use the scale of knowledge dissemination in production, and strategies that combine innovation with specific priorities of the national economy will give a much better chance of success);

2) learning from past experience (traditional regional strategies have, as a rule, the following disadvantages: lack of international and interregional perspectives, low level of R&D

in the industrial and economic structure of the region, lack of a clear analysis of the region's assets, historical development priorities, often "blind" copying of other people's experience without taking into account the local regional context);

3) development and application of entrepreneurial potential ("smart specialization" solves the difficult task of choosing priorities and allocating resources, enabling business entities to demonstrate the most promising areas for future regional development through the process of enhancing entrepreneurial activity and unlocking entrepreneurial potential);

4) stimulating regional changes (smart specialization strategies require structural regional changes for the following objective reasons:

- the transition from the existing sector of the economy to the new is possible only on the basis of cooperation of the participants and the processes that form the knowledge base for the development of a new type of activity;

- technological modernization in the existing industry involves the development and implementation of stimulating technologies to improve the efficiency and quality of development in the traditional sector;

- diversification should provide synergy, making the transition to a new activity attractive and profitable;

- the creation of a radically new field involves the sharing of R&D results and innovations related to entrepreneurial activity);

5) strengthening the role of each region in the innovative development of the national territory (the strategy of "smart specialization" should take into account geographical factors and specific characteristics that contribute to regional innovation development, and therefore it is worth noting the following important aspects:

- the process of disclosing entrepreneurial potential will take place differently in each specific region;

- when determining priorities, it is necessary to take into account the principles of regional specificities and the interconnectedness of regions among themselves;

- "smart specialization" should link new areas of activity, based on the knowledge of various actors in the region and beyond, i.e. at the regional and interregional levels;

- integration of policies at the regional level is necessary for an integrated and systematic approach to solving problems of innovative development).

In order to form a "smart specialization" strategy in the EU, a guide on research and innovation strategies has been developed (RIS3 Guide) [5]. This document is a starting point in the strategic process of the regions and is a methodological toolkit that supports the development and implementation of a strategy of "smart specialization". The Guide was developed as a "living document", which will be supplemented and updated on a regular basis based on the results of applying the concept of "smart specialization" within the framework of the EU innovation regional policy. Such an approach can be considered effective, since it allows to improve previous knowledge and experience, taking into account new emerging features and aspects. It turns out that initially conditions are created to support measures to revise and modernize already developed and implemented strategies, along with the formation of new ones. All these actions make it possible to strengthen horizontal ties in the regional interaction of the territories, as well as generally stimulate sustainable growth, form social innovations and develop innovative skills. In a generalized form, the methodology of "smart specialization" is presented in Figure 1.

The RIS3 methodology is a logical six-step approach to the process of forming a strategy for innovative development of a territory. These six stages can be represented as follows:

1. Analysis of the regional context and innovation potential.
2. Creating a robust and inclusive governance structure.
3. Developing a common vision of the "future" region.
4. Prioritization.
5. Strategy development.
6. Integration of monitoring and evaluation mechanisms.

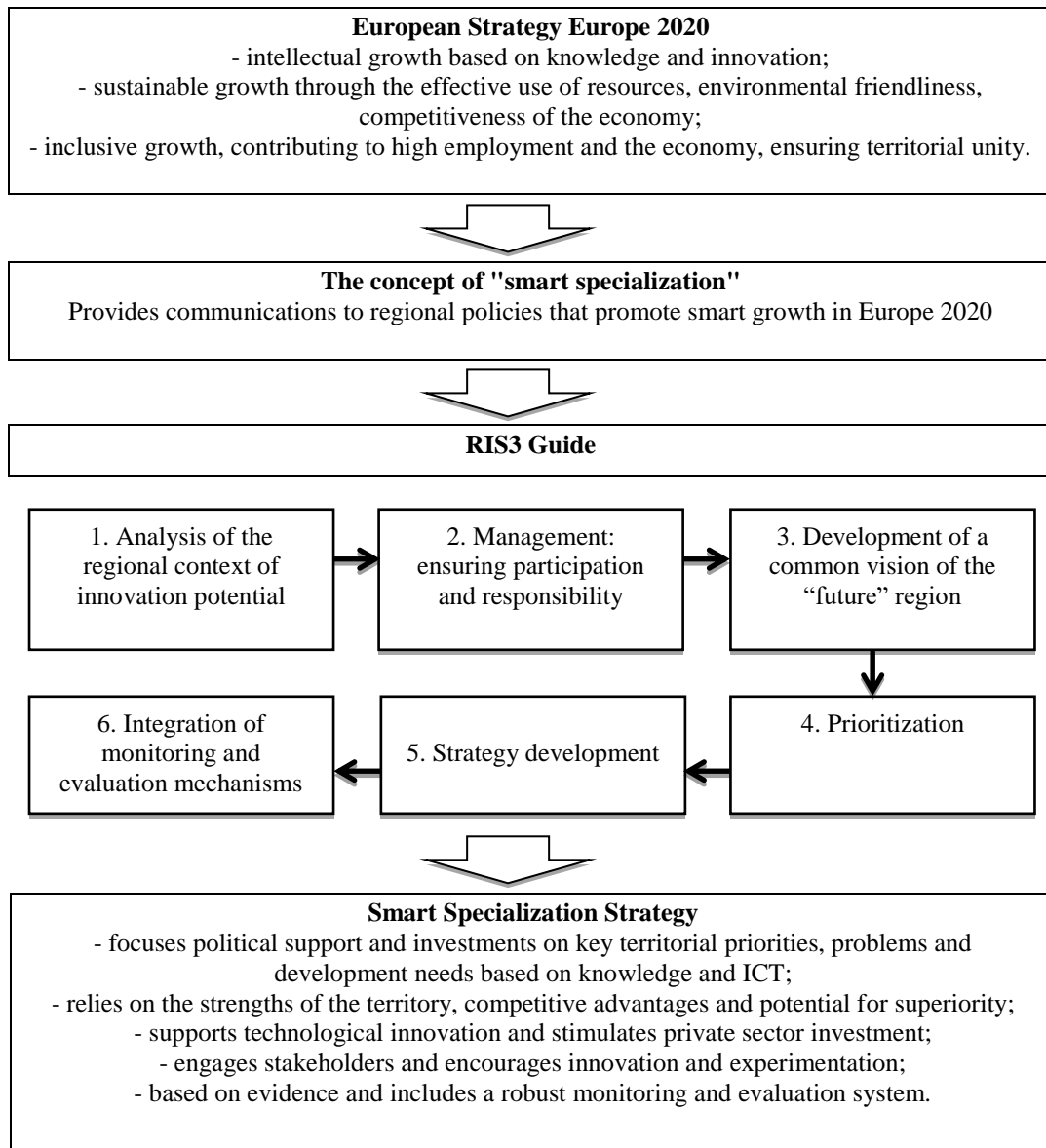


Fig. 1. Smart Specialization Methodology

It is important to note that these stages can be implemented consistently, but they will overlap in time and in the targets with the arrival of new participants and the disclosure of new aspects of the innovation potential. Therefore, they should not be viewed as autonomous stages, but as an interaction of the components of the strategic process, taking into account the specifics of the regional context.

III. THE PROBLEM OF CHOOSING THE PRIORITY OF INNOVATIVE DEVELOPMENT OF THE REGIONS OF RUSSIA

Research conducted by scientists confirms the fact that the choice of priorities in the constituent entities of the Russian Federation is in most cases intuitive and not based on a detailed analysis of resources and available potential [6]. In particular, it is determined that one of the weak points in the development of regional innovation policy is the insufficient analysis of regional potential. In this regard, the purpose of this study is to develop a methodological approach to the analysis of the regional context and potential for innovation in order to choose a unique territory specialization, as well as to offer a platform tool for solving the problems of innovative

development of Russian regions. The methodical approach was developed taking into account the successful European experience and the characteristics of statistical information and innovation policy in Russia.

So, according to the RIS3 Guide, a regional innovation strategy should be based on a thorough analysis of the regional economy, social sphere and innovation structure, aimed at assessing existing assets and future development prospects [5]. A prerequisite for such an analysis is the consideration of all types of innovation, both technological and social. In domestic statistics, there is no information about social innovations, which makes it difficult to conduct such a regional analysis. The analysis should be carried out in three planes:

1) Regional assets (assessment of existing potential, analysis of strengths and weaknesses in the region, opportunities for innovative development and threats to society). Analysis tools: SWOT analysis, regional mapping studies, targeted surveys and peer reviews;

2) The place of the region in the country and the world. Analysis tools: systematic comparison with other regions,

mapping the national and international context, identifying relevant links and flows of goods, services and knowledge, revealing possible integration schemes with partner regions, interview rounds with other regions and interregional working groups;

3) Analysis of the business environment. Analysis tools: technology audit, interviews with cluster management and companies, mixed working groups, creation of an observatory and monitoring organizations.

The concept of “smart specialization” is based on the principle of differentiation: thanks to the unique capabilities of a particular territory, a region can create its competitive advantage based on innovation based on its potential. In this regard, a comprehensive analysis of regional specifics is especially important, allowing to evaluate not only the technological and scientific, but also the economic and social specialization of the territory.

In turn, analysis of only internal information cannot provide an objective picture of the situation in the region. Another feature of the European concept of "smart specialization" is the need for continuous comparative analysis with other regions and the definition of its position in the country and the world. A simple comparison with other regions or countries is associated with a number of shortcomings, among which is a linear view of innovation.

In addition, the analysis of the regional context should be based not only on statistical data, but also on so-called entrepreneurial knowledge. According to the European RIS3 Guide, business entities are necessarily involved in the development of innovative regional strategies. It is an analysis of the business environment that can provide the necessary information about potential areas of development of the region. Such an analysis must necessarily include tools for interaction and cooperation between the business sector and authorities.

IV. METHODOLOGICAL APPROACH TO THE ANALYSIS OF REGIONAL CONTEXT AND POTENTIAL FOR INNOVATION IN ORDER TO CHOOSE A UNIQUE TERRITORY SPECIALIZATION

It is impossible to offer an integrated methodology for analyzing regional context and potential for innovation, since the evaluation is based on both quantitative and qualitative information. In this regard, the proposed methodological approach to the analysis of the regional context and potential for innovation in order to select a unique specialization of the territory reflects the logic of the analysis but is not a fully working tool. Restrictions on the use of this approach are largely determined by the peculiarities of domestic statistics, the lack of data for comparative regional analysis, the complexity of the problem being solved and the need to analyze a large amount of heterogeneous information. The approach is based on the principles of the concept of “smart specialization” and consideration of the priorities of the scientific and technological development of Russia.

The proposed methodological approach to the analysis of the regional context and the potential for innovation in order to select a unique territory specialization is presented in Figure 2.

The proposed approach includes four areas for analysis:

- 1) analysis of the scientific and technological potential of the region;
- 2) analysis of the economic potential of the region;
- 3) analysis of the entrepreneurial potential of the region;
- 4) regional foresight analysis.

To analyze the first three areas, it is necessary to single out the parameters that allow assessing the potential of the territory in modern conditions. In the framework of this study, the parameters for analysis were selected on the basis of studying statistical information in the innovation sphere [1,2,3]. At the same time, it is proposed to analyze the regional context in order to select a unique territory specialization in terms of the priorities of the scientific and technological development (STR) of Russia, presented in the relevant strategy [7]. In an integrated form for convenience in the methodological approach priorities are formulated as follows:

- 1) advanced digital, intelligent manufacturing technologies, robotic systems and new materials;
- 2) environmentally friendly and resource-saving energy;
- 3) personalized medicine, high-tech healthcare and health-saving technologies;
- 4) highly productive and environmentally friendly agricultural and aquatic economy;
- 5) technologies of countering technogenic, biogenic, sociocultural threats, terrorism and ideological extremism;
- 6) technologies for creating intelligent transport and telecommunication systems;
- 7) advanced social technology.

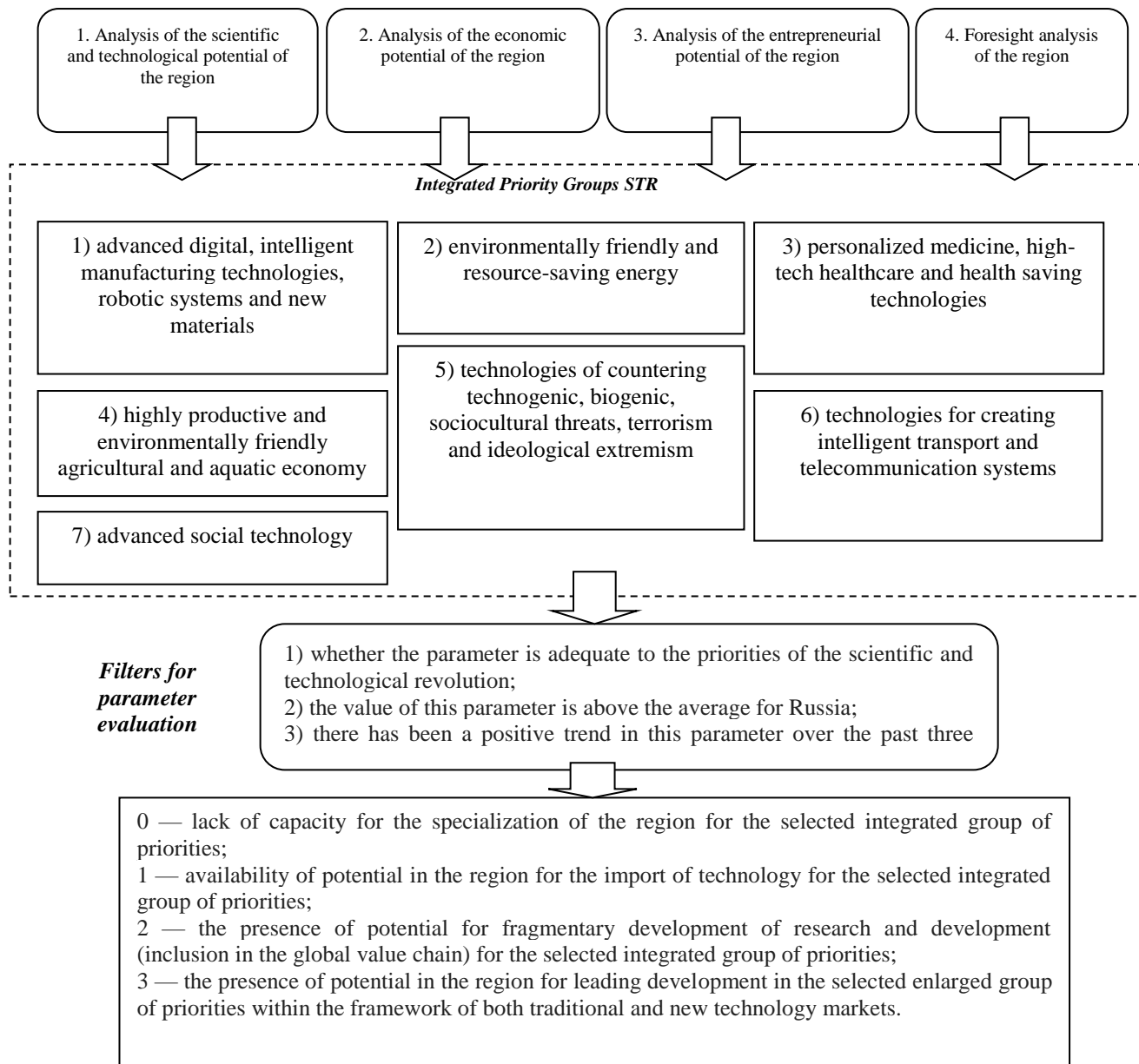


Fig. 2 — The proposed methodological approach to the analysis of the regional context and potential for innovation in order to select a unique specialization of the territory

The parameters presented in Table 1 at the first stage are estimated by analysts in quantitative terms in the context of integrated groups of STR priorities, and then at the second stage, the expert evaluation of the results obtained is carried out. A distinctive feature of such an expert assessment is the consideration of the data obtained at the first stage from the point of view of three filters:

- 1) whether the parameter is adequate to the priorities of the scientific and technological revolution;
- 2) the value of this parameter is above the average for Russia;

- 3) there has been a positive trend in this parameter over the past three years.

TABLE 1. PARAMETERS FOR ANALYZING REGIONAL CONTEXT AND POTENTIAL FOR INNOVATION IN ORDER TO SELECT A UNIQUE TERRITORY SPECIALIZATION

Directions of analysis	Parameters for analysis
1. Analysis of scientific and technological potential	1) analysis of the level of funding for research and development (Internal costs of research and development as a percentage of GRP); 2) the proportion of people engaged in research and development in the average annual number of people employed in the regional economy; 3) the number of articles published in peer-reviewed journals, indexed in the Russian Science Citation Index (RSCI), per 10 researchers; 4) the number of patent applications for inventions filed with Rospatent by national applicants per million people of the economically active population of the region; 5) the number of advanced production technologies developed in the region per million of economically active population; 6) the ratio of revenue from technology exports to GRP (per 1 thousand rubles. GRP).
2. Analysis of the economic potential for the development of innovation in the region	1) the proportion of people employed in knowledge-intensive service industries in the total number of people employed in the regional economy; 2) GRP per person employed in the region's economy; 3) the proportion of people employed in high-tech and medium-technology high-level industries of industrial production in the total number of people employed in the regional economy; 4) the proportion of the population aged 25–64 years with a higher education in the total population of the relevant age group; 5) the number of students enrolled in educational programs of higher education — undergraduate programs, specialty programs, graduate programs, per 10,000 population.
3. Analysis of entrepreneurial potential	1) the share of funds of organizations of the business sector in the total domestic expenditure on research and development; 2) the proportion of organizations implementing technological innovations in the total number of organizations (by organizations of industrial production); 3) the proportion of organizations that participated in joint projects for the implementation of research and development in the total number of organizations (by organizations of industrial production); 4) the proportion of organizations engaged in non-technological (marketing and / or organizational) innovations in the total number of organizations (by organizations of industrial production); 5) the proportion of small enterprises that carried out technological innovations in the total number of small enterprises (by industrial production enterprises); 6) the intensity of the cost of technological innovation (for industrial production organizations); 7) the proportion of innovative products, works, services in the total volume of goods shipped, work performed, services (by organizations of industrial production); 8) the proportion of newly introduced or subjected to significant technological changes in innovative products, works, services, new to the organization's sales market, in the total volume of goods shipped, works performed.

This approach allows you to convert the quantitative parameters into a single qualitative assessment that characterizes the possibility of developing an integrated group of priorities for a scientific and technological revolution in the region. At the same time, the assessment of opportunities is carried out at several levels:

0 — lack of capacity for specialization of the region in the selected integrated group of priorities of the scientific and technological revolution;

1 — availability of potential in the region for the import of technology for the selected integrated group of priorities of scientific and technological revolution (STR);

2 — the presence of potential for fragmentary development of research and development (inclusion in the global value chain) for the selected integrated group of priorities of the scientific and technological revolution;

3 — availability of potential in the region for leading development in a selected enlarged group of priorities within

the framework of both traditional and new markets for scientific and technological development technologies.

Foresight analysis is a mandatory component of the regional context analysis. Experts from government, science and education, the business community and the public are involved in it. In the framework of the foresight session, the experts also assess the potential and opportunities for the development of each integrated group of priorities of scientific and technological development at levels from 0 to 3.

At the third stage of the proposed approach, the result of the final assessment of the regional context and potential for innovation in order to select a unique territory specialization in terms of the priorities of the scientific and technological development of Russia is recommended to be presented in the form of a matrix (Table 2).

TABLE 2. THE RESULT OF THE FINAL ASSESSMENT OF THE REGIONAL CONTEXT AND POTENTIAL FOR INNOVATION IN ORDER TO SELECT A UNIQUE SPECIALIZATION OF THE TERRITORY IN TERMS OF THE PRIORITIES OF THE SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT OF RUSSIA (EXAMPLE) *

Direction for analysis / STR Priority Group	1	2	3	4	5	6	7
1) analysis of scientific and technological potential	1	1	0	1	0	0	2
2) analysis of economic potential	1	2	0	2	0	0	1
3) analysis of entrepreneurial potential	2	1	0	2	0	0	2
4) regional foresight analysis	2	1	0	3	0	0	2
Weighted average	1.5	1.2	0	2	0	0	1.7

* At the same time, the weight of directions for analysis is assumed to be 0.25.

In the considered example (Table 2) the integrated groups of priorities 1, 2 and 7 deserve the most attention. In order to specify the priorities recommended for specialization in the region, at the next stage, a foresight session is held for each of the enlarged priority groups.

The main limitation of the application of the proposed methodology is the outdated classification of industries, which is used in statistical studies of the regional economy, as well as the lack of a database of regional profiles and priorities of the subjects of the Russian Federation.

V. PLATFORM APPROACH AS A DIGITAL ECONOMY TOOL IN SOLVING PROBLEMS OF INNOVATIVE DEVELOPMENT OF THE TERRITORY

All the arguments presented above can have an effective practical application only if there is an adequate information and communication tool. A mechanism is needed that will complement the methodical approach proposed in the study with an information and communication support system. For this purpose, it is proposed to use a platform approach for research purposes, which is especially important in the modern conditions of the digital economy. Since external calls are mostly associated with the development of the knowledge society and digitalization, an objective need arises to create a new environment for interaction — a platform environment where each participant can interact with others by performing the necessary transactions for him (Figure 3). Therefore, the global trend of digital transformation can be decomposed into the following components:

1) transition to the organization of interaction between market participants on the basis of decentralized networks;

2) the formation of a digital economy based on a common (existing) with the development of non-profit digital infrastructure and services created on the basis of the platform with the direct participation of all stakeholders;

3) increasing the overall efficiency due to the platform approach, namely:

- reduction of transaction costs (costs of searching for information, entering into a contract, assessment and expertise, legal protection and protection against unfair behavior of participants);

- obtaining a network effect (bringing together participants in the innovation process, the platforms contribute to a constant cyclical increase in volumes, which shifts costs and risks from the businesses themselves to the network);

- consistency of technologies (cloud technologies, automation, analytics, artificial intelligence, the Internet of things in synergy create a fundamentally new "service economy");

- open data (having access to a huge stream of relevant information, participants can develop new solutions, offers, and services that contribute to innovative development, which can competently integrate into the existing ecosystem).

The unique strength and value of the platform lies in the ability to facilitate and make effective communication between the participants. Therefore, it can be argued that the platform approach is aimed at creating constructive solutions aimed at gathering participants in the innovation process, giving them the necessary infrastructure for interaction and information retrieval, easy contracting and further progress towards commercialization and revitalization of business activities.

The platform approach implies the development of such a digital transformation tool for the economy as a "digital platform" in solving the problems of innovative development of territories. Today, within the framework of the Digital Economy of the Russian Federation program, the digital platform is defined as "a system of algorithmic mutually beneficial relationships of a significant number of independent participants in the industry (or field of activity) implemented in a single information environment, leading to a reduction in transaction costs through the use of digital technology with data and changes in the division of labor"[8].

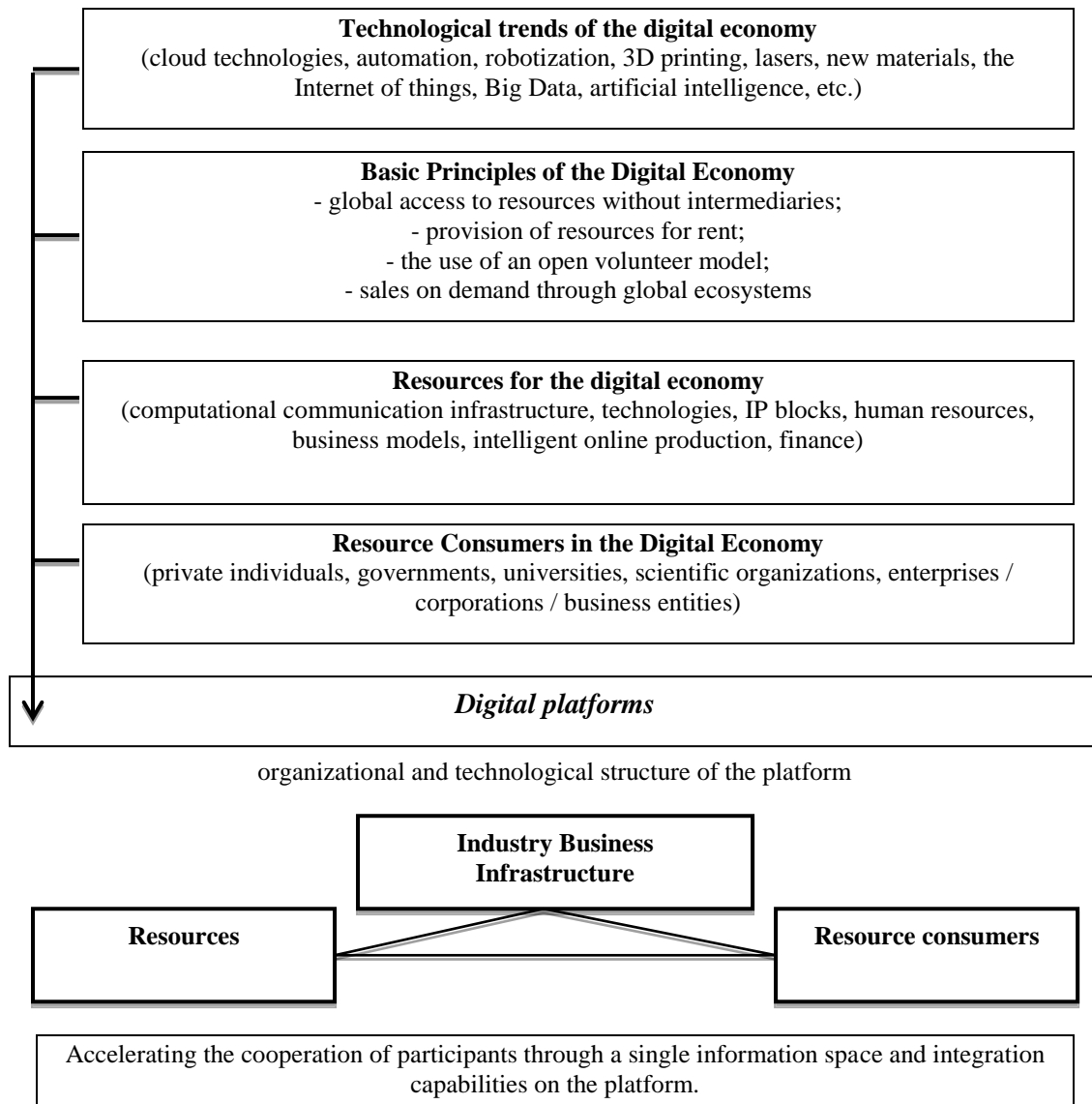


Fig. 3 — Basic elements of the digital economy

To solve the tasks of activating the innovation activity of the territories, priority is given to the development of innovative ecosystems and open innovations on a platform basis involving a wide range of users. Therefore, in this study, the leading role is given to the “open innovation platform” as an actual mechanism based on modern digital management tools that form a qualitatively new space for constructive and effective interaction. In this context, a platform can be understood as new interaction formats that stimulate the development of a culture of open innovation, communication and partnership [9].

The proposed platform approach to the innovative development of territories focuses on the organization of “horizontal flows” and the integration of knowledge of a different nature. This will help improve the performance of participants in the innovation strategy. From the standpoint of the “smart specialization” concept, the open innovation platform will not only integrate diverse knowledge bases, participants and technologies, but also coordinate innovation

activities and the process of forming an innovation strategy for the development of Russian regions.

To integrate the platform approach into the developed methodology, innovative profiles of the regions will be presented on the website of the proposed digital platform. Attracting external experts at the analytical stage of the development of an innovation strategy for a region may also be available on the platform. In this case, the role of experts may be different: from simple consultation to training and decision support.

VI. CONCLUSIONS

Digitalization and digital transformation are associated with the spread of a new innovation-technological paradigm of development of territories, a fundamental change in the value chain, a steady transition from the “knowledge economy” to the “economy of action”, consumer involvement in the production process, the development of new educational models. all spheres of activity of economic entities, as well as the overall development of Industry 4.0 and the transition to a

new technological structure [10]. Concerning this the presented concept of "smart specialization" allows the development of a regional development strategy to make a choice in favor of innovation. "Smart specialization" is not the creation of a monoculture and uniformity of technology, but, on the contrary, a development that promotes greater diversity. And this means the inevitability of structural regional changes, involving the transition to a new activity or the diversification of existing economic sectors in the region. The proposed methodology for analyzing the regional context for the purpose of choosing a unique territory specialization is carried out in the context of the priorities of the scientific and technological development of Russia. It should be noted that the presented list of parameters for the analysis of the regional context and the potential for innovation are not exhaustive. With the advent of new technologies, new principles of collecting and analyzing statistical information will be formed, both at the federal and regional levels. Therefore, in future studies, this list should be supplemented and adjusted.

The validity of the choice of a platform approach to solving the problems of the innovative development of Russian regions is confirmed by the following highlighted functions of the proposed digital platform:

1) involvement of research organizations, authorities and citizens through an online platform on which any resident of the country can make ideas and suggestions related to the formation of scenarios for the development of science, technology and innovation in a country or a specific region;

2) creating and maintaining a database for storing, analyzing, comparing and distributing the best available practices and tools in the field of scientific and technological revolution.

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