

Rural Territories' Digitalization: from Theory to Practice*



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Abstract. Large-scale application of digital technologies in management, social, and business processes determines the relevance of the inclusion of digital transformation factors in the socio-economic potential assessment of territorial systems. However, the applied methods of analyzing digitalization processes do not allow reflecting the influence of multi-level spatial set of digital transformation factors of life spheres on the process of potential formation and development of the country and its regions. The purpose of the research is to substantiate the need to include digitalization factors in the assessment of the aggregate potential of territorial socio-economic systems, to develop and test a methodology for integrative impact assessment of digital transformation factors on the state and socio-economic potential growth of territorial systems. The author uses the methods of analysis and synthesis, comparison and grouping, generalization and expert assessments, index and correlation methods of economic and statistical analysis. The working hypothesis of the undertaken research suggests a possibility of developing and applying a methodological approach to the analysis of the state and dynamics of digitalization processes reflecting the interdependence of characteristics of rural territories' potential and digital transformation parameters of rural life sphere. The paper defines the concepts of digitalization and digital potential, gives an annotated list of the main methodological approaches to assessing the territorial system's potential, proposes and tests the author's methodology version for analyzing and evaluating digitalization potential of rural territories, substantiates the model of a single digital platform for the purposes of state strategic planning for sustainable development of rural territories, structures the set of directions for digital transformation

* Funding: The reported study was funded by RFBR, project number 20-11-50196.

For citation: Sovetova N.P. Rural territories' digitalization: from theory to practice. *Economic and Social Changes: Facts, Trends, Forecast*, 2021, vol. 14, no. 2, pp. 105–124. DOI: 10.15838/esc.2021.2.74.7

of region's life subjects, and forms a multi-level set of indicators for comparable assessment of the state and dynamics of digital transformation development which is useful for developing options for setting priorities when justifying strategic decisions in digitalization. The scientific novelty of the research is that for the first time there was an attempt to develop a methodological approach to assessing territorial system potential taking into account the factors of digital transformation of processes in the field of production, exchange, distribution, and consumption of public products.

Key words: digital transformation, rural territories' potential, rural territories' digitalization.

Introduction

Achievement of the goals of Russia's socio-economic development is inextricably linked to a consistent implementation of digital technologies in management, social, and business processes. Starting with the IT sector, active use of digital technologies is a driver of sustainable economic development including agriculture that is the main employment area in rural territories.

Scientific research, related to the problem of growth and effective use of socio-economic potential of rural territories, indicates not only the urgent need to solve it, but also the positioning, on the one hand, of the factors and conditions for its resolution, and, on the other hand, the identification of priority areas for sustainable development of rural territories of the Russian Federation. In our opinion, we should also identify the third system-forming side: namely, innovative platform creation for building rural territories' potential and prerequisites for receptivity of rural economy and population to innovations (primarily the transition to digital, intelligent production technologies, robotic systems, new materials and construction methods, systems creation for processing large amounts of data, machine learning and artificial intelligence, etc.) within the framework of the implementation of the catch-up development paradigm and model of circular (waste-free) economy of agro-industrial complex. Based on this conceptual view, the author adopts the working research hypothesis which suggests possibility of developing and using a methodological

approach to the analysis of the state and dynamics of digitalization processes in rural territories, reflecting the interdependence of characteristics of rural territories' potential and digital transformation parameters of rural life sphere.

The tasks of the research are: 1) to select a methodological approach to assessing rural territories' potential taking into account economic digitalization; 2) to develop a model for classifying rural territories by development level and tools' susceptibility for digital transformation of operating environment; 3) to justify a single digital platform for planning sustainable development of rural territories in the context of economic digitalization.

Scientific works note processes activation of domestic business inclusion in the global digital transformation which contributes to competitiveness growth. For instance, according to the Higher School of Economics, the overall business digitalization index in 2018 reached a value of 31 units¹. The leading industries are telecommunications (index 41) and wholesale and retail trade (index 39). The share of gross domestic expenditures on digital economic development in the Russian Federation in 2018, compared to 2017²,

¹ Abdrakhmanova G.I., Vishnevskii K.O., Golkhberg L.M. et al. *Digital Economic Indicators: 2020: Stat. Coll.* National Research Institute "Higher School of Economics". Moscow: NRI HSE, 2020. P 360.

² Abdrakhmanova G.I., Vishnevskii K.O., Golkhberg L.M. et al. *Digital Economics: 2020: Brief Stat. Coll.* National Research Institute "Higher School of Economics". Moscow: NRI HSE, 2020. P. 112.

increased to 3.7% of GDP, mainly due to an increase in the share of household expenditures on the use of digital technologies and related goods and services. In the structure of gross domestic expenditures for digital economic development, business sector (44.6%) and households (36.8%) have identified themselves on a large scale.

Population is more often using digital technologies: the share of households with the Internet access (as a percentage of total number of households) has increased from 48.4% in 2010 to 76.6% in 2018, with 68.8% of residents using the Internet every day. The level and range of digital population's skills are expanding (despite the existing low level in relation to other countries). 54% of the surveyed citizens have a positive attitude to robotics, noting that robots are a good thing for humanity (they can serve as assistants in household chores – 66%, deliver goods from stores – 62%, and be legal consultants – 53%). At the same time, 89% of population aged 18–65 years believe that robots can perform work that is too heavy or dangerous for humans.

The agro-industrial complex is expanding the range of applications of intelligent technologies, primarily unmanned vehicles and aircraft, tractors, indicators and sensors, as well as GLONASS / GPS systems and IoT platforms. In addition to automation (robotization) and visualization of production processes, real-time update of information. The main advantage in this case is the ability to enter into economic circulation of hard-to-reach territories.

Information and communication technologies are used by 89.5% of business organizations in the Russian Federation, 86% of them have broadband Internet. In 2018, 90% of business organizations had access to the Internet, but only 49% of them had a website. Authorities are more active in the ICT usage (97.6% is regional authorities, 95.1% – local governments).

According to the research materials of the Higher School of Economics³, 19.9% of organizations use the Internet for purchases, 15.4% – for sales. Cloud services are used by 36.4% of organizations in the telecommunications sector, 36.2% in wholesale and retail trade, and 35.5% in the information technology industry. Business software is mainly used for financial calculations (57.7%). State and municipal services are received in electronic form by 54.5% of the population aged 15–72 years, and 68.3% of organizations are in the business sector. The business sector prefers to work with authorities in online interaction form for sending and downloading official forms, obtaining information from the websites of state authorities. In the ICT sector in the Russian Federation, the share of employees is 1.6% of a total number of employees, the contribution of the ICT sector to economic development was 14.3% of the GDP in trade in 2018, 3.2% is in agriculture.

The aforementioned characteristics of digitalization directions are based on official sources of statistical information and are not divided by subjects of urban and rural areas, as the Rosstat does not group them on this basis. Only some municipalities make independent, proactive attempts at differentiated analysis and assessments.

It is well known that socio-economic processes occurring in rural areas are influenced by the specifics of the conditions for production implementation, its territorial dispersion, highly specialized nature of economic activity, peculiarities of living in rural areas and territories' inaccessibility. Digital technologies development depends not only on the need to strengthen the competitive position, i.e. the action of the market mechanism, but also on the tasks of ensuring acceptable living standards for population. Farming, in addition to

³ Abdrakhmanova G.I., Vishnevskii K.O., Golkhberg L.M. et al. *Digital Economics: 2020: Brief Stat. Coll.* National Research Institute "Higher School of Economics". Moscow: NRI HSE, 2020. P. 112.

the goals of agribusiness and achieving benefits, is more driven by the task of survival. This requires the representation of agriculture primarily as the habitat of rural residents. It is worth noting that currently there is degradation of socio-economic sphere and partial socio-economic “desertification” of rural territories, the all-Russian trend of reducing the share of rural residents in the total population continues.

The content of the formation processes and emerging characteristics of socio-economic potential of rural territories undoubtedly determine pace and possibilities of using digital technologies, but, simultaneously, they require tracking and studying these trends, analyzing and assessing the degree of demand and readiness for digital transformation of socio-economic processes, identifying the prerequisites for the use of digital technologies in the management of rural development.

Theoretical and methodological aspects of the research

In scientific research, there are several approaches to interpreting “rural territory” concept. For instance, from the point of view of sociology and geography, rural territory means, first of all, human activity zone and, to a lesser extent, the field of economic activity or administrative borders [1]. Rural territory is also represented as a system consisting of two subsystems – a social subsystem and a subsystem of territories that closely interact with each other⁴. RAS Academician Kuznetsov V.V. defines rural territory as an area of rural settlements including urban settlements that are an administratively part of rural municipal districts [2].

Most authors consider rural territories complex socio-economic systems, represented by rural settlements and adjacent inter-settlement territories with their characteristic low population density,

mandatory availability of agricultural land and other natural resources [3; 4; 5]. Several scientists present rural territory as an area located outside of large towns having diverse resource potential with certain conditions for its use, the presence of basic production assets similar to the territory’s industrial structure, and rural residents with their own way of life and culture [6; 7; 8].

In the Government Decree of the Russian Federation no. 696, dated May 31, 2019 (as amended on July 10, 2020), “On Approval of the State Program of the Russian Federation “Integrated Development of Rural Territories”, rural territories are understood as rural settlements or rural settlements and inter-settlement territories united by a common territory within the boundaries of a municipal district; rural localities that are a part of urban settlements, municipal districts, urban districts (with the exception of urban districts, on the territories of which the administrative centers of the entities of the Russian Federation are located); rural localities that are a part of the inner-city municipalities of Sevastopol; workers’ settlements that have the status of urban settlements; workers’ settlements that are a part of urban settlements, municipal districts, and urban districts (with the exception of urban districts where the administrative centers of the entities of the Russian Federation are located). In the current study, the author relies on this definition.

In the conventional sense, “potential” is reduced to a designation of opportunities for further use for development. In relation to territory’s potential, it is an open-type system, the main structural elements of which are natural conditions and the environment state, population and the quality of labor resources, the amount of fixed capital and the level of technological production equipment, application scale of the results of scientific and technological progress, regional geopolitical conditions, auxiliary and social infrastructure [9; 10]. Other scientists emphasize

⁴ *Sustainable Development of Rural Territories: Scientific Studies of Nikonov ARAPI*. Ed. by Petrikov A.V. Moscow: Nikonov ARAPI, 2009. P. 272.

that development potential of rural territory is a set of natural, economic, social, national, human (labor, demographic) resources that ensure the sustainable socio-economic development of the territory, its competitiveness and positioning in the domestic and global markets on the basis of expanded reproduction in accordance with economic laws and legal conformities [11].

From the point of view of the tasks of social management, rural territories are a platform not only for the sphere of production, but also for the social sphere, and therefore the author focuses on the mandatory consideration of the potential of the territory in terms of opportunities for creating comfortable living conditions for population, developing infrastructure, and improving the quality of life of rural residents. In modern conditions, rural development potential should be considered as the ability to long-term (long-term) sustainable functioning, ensuring competitive advantages in the domestic and foreign markets, based on the strategy of innovative and technological development. Numbers are inseparable from the strategic management.

The term “digital economy” was first used in 1995 by N. Negroponte [12; 13; 14], who designated the concept of electronic (digital) economy. According to Professor R.M. Meshcheryakov, on the one hand, the digital economy is based on digital technologies in the field of sales of goods and services, on the other – it is economic production using digital technologies⁵. In a narrow sense, the digital economy is understood as a type of commercial activity carried out in the electronic space. In a broad sense, it is the entire

⁵ R. Meshcheryakov explains: “Currently, some experts believe that it is necessary to expand this understanding and to include the chain of goods and services that are provided using digital technologies, including such concepts as the Internet of Things, 4.0 Industry, smart factory, fifth-generation communication networks, engineering prototyping services, etc.” [Which is more important: real or digital economy?]. *Information and Analytical Center (IAC)*, dated September 12, 2017. Available at: <http://inance.ru/2017/09/cifrovaya-ekonomika>

society transformation against the background of introduction of information and communication technologies [15].

Digital economy is a model reflection of economic relations of production, distribution, exchange and consumption based on information and communication technologies [16; 17]. The field of interests of the digital economy is personnel and education, information infrastructure, information security, legal regulation [18]. Professor A.V. Minakov believes that digital economy is the economy based on computer technologies covering all life spheres and focused on a consumer in order to improve provision of services in trade, transport, medicine, education, culture and other areas, operating with information stored in databases [19]. According to the departmental project “Digital Agriculture”⁶, digital economy is an economic activity based on digital technologies related to e-business and e-commerce, electronic goods and services produced and sold by them.

The variety of approaches of modern scientists to the content of the “digital economy” definition forms a variety of opinions on understanding the “digitalization” category. According to Professor L.V. Lapidus, digitalization is a transition process to a digital region, transformation of processes of cross-regional, intersectoral, interpersonal interaction in the region due to the penetration of digital technologies, aimed at improving population’s quality of life, competitiveness of the Russian economy, ensuring national security and sovereignty of the country [20]. Digitalization is also considered a new product creation in digital form with new properties and competitive advantages [21; 22].

From the standpoint of state regulation of socio-economic processes, we can argue that digitalization indicates economic formation in which technologies are used to initiate certain actions without human

⁶ *Departmental project “Digital Agriculture”: official edition*. Moscow: FGBNU “Rosinformagro-tech”, 2019. 48 p.

intervention, that is, so-called smart production systems are formed, where all subsystems (resources, equipment, logistics, marketing and other schemes) are covered by a single communication network which greatly expands the possibilities to improve the production process stages, reduce production costs, improve management efficiency and respond flexibly to new customer requests. The merging of online and offline spheres, development of the Internet and mobile communications are the “basic technologies of digital economy”, their introduction in all spheres of activity is caused by a rapid spread of touch devices and large databases [23; 24].

In our study, we understand rural territories' digitalization as transformational processes of promoting digital technologies in the course of rural development and managing life sphere of rural population for effective use of rural territories' potential, creating modern jobs and comfortable living conditions for people, sustainable economic growth and improving living standards.

Substantiation of the methodological approach to assessing rural territories' potential in the context of digital society transformation

Territorial system potential is formed under the influence of many multidirectional factors. To measure its accounting, the methodology of scientific research includes a number of developed and tested approaches. They allow not only evaluating it, but also identifying development trends and predicting prospects.

The sectoral approach to assessing rural territories' potential [25] is based on an assessment of sectoral growth elasticity for each studied industry, the level of its intensification and investment attractiveness which ultimately allows using cluster analysis to express an indicator of territories' socio-economic potential.

Index approach [26; 27] is based on application of a set of not only socio-economic indicators, but also indicators of related areas that have a direct impact on the sustainability of territorial deve-

lopment reflecting the strengths and weaknesses of the socio-economic situation of a particular territory.

The indicative approach to assessing the organizational and economic potential of rural territories [28; 29; 30] takes into account, in addition to the investment capital and natural resource base, living conditions of rural population, includes operations for ranking indicators and calculating the overall integral indicator of rural territories' competitiveness (based on individual indices).

Resource approach to assessing rural territories' potential is based on the use of closed one-point scale, followed by the calculation of the integral indicator for the resource block taking into account the correction factors. This allows displaying the specialization nature of production activities taking into account the resource intensity of individual branches of the agro-industrial complex, to express the need for material investments in the resource base for the long term, to build optimization models in the distribution processes of public and private investments [31].

S.V. Baramzin's approach [32] includes determining the rating (with interval ranking) of rural territories based on a set of indicators of economic, social, and financial condition, forming intermediate results of assessments and the possibility of integration into the consolidated rating of a rural settlement.

Social potential assessment of rural infrastructure [33] is carried out by means of satisfaction coefficients based on the measurement of the human development index (HDI) and conducting sociological monitoring of the quality of regional management (“Quality Rose” method) by identifying “problem” social zones.

The integral approach to assessing rural territories' potential, used by a group of authors [34; 35; 36], is based on the calculation of

generalized integral indicator of socio-economic development level that is tracked according to Rosstat.

Each of the aforementioned methodological approaches has its own advantages and limitations, but, at the same time, allows more or less translating general and special in assessing municipalities' potential as a whole. However, their common disadvantage is the lack of a statistical base for studying the potential of a particular rural area. Statistical information, used by individual scientists (as reference points for calculating the potential) for rural territories, has a narrow range of indicators, and is subject to constant changes in reporting forms (since 2014). This, in turn, leads to the complication of research activities, limited analysis capabilities, which, in relation to the tasks of implementing the country's innovation development strategy, imposes additional difficulties in forming database.

It is necessary to state that there is still no active orientation of the methodological tools to the tasks of studying interdependence of digital transformation processes and the potential state of national and regional socio-economic systems.

Nevertheless, orientation issues of methodological approaches to the study of innovative development problems are beginning to attract the attention of state statistical services. Digitalization puts the task of tracking these processes by statistical services on the agenda. In particular, the working group of the Organization for Economic Cooperation and Development has prepared proposals for the structure of digital economy satellite account, the main objectives of which are to 1) provide users with a sufficiently reliable assessment of what is measured in the digital economy, 2) determine what cannot be measured within the current methodology, 3) enable international comparisons of key indicators describing digital economy [37].

Based on the research tasks, we propose a methodological approach development to assessing

rural areas' potential. It is based on the use of a number of provisions of the methodological approaches, discussed above to the potential analysis of territorial systems and methodological tools for assessing digitalization, tested in studies of the Institute of the Information Society (IIS), reviews of the World Bank and the Analytical Center for the Government of the Russian Federation.

We emphasize that digitalization of interaction processes in the socio-economic territorial system creates, through penetration of digital technologies, opportunities to increase economic competitiveness, increase the level and quality of population's life, contributes to creation of new products and services (or their digital forms) and, in the same way, acts as a structural formation element of new level of territorial system's potential. Covering production subsystems (resources, equipment, transport and logistics and marketing modules), a complex of industries of production and social infrastructure, as well as organization and management process, digitalization is a new potential component of the territorial and spatial system.

Therefore, it is possible to talk about digital and non-digital components of potential, respectively, about digital and non-digital criteria for its assessment, to develop and test models and methods for measuring the impact of, for example, tools and processes of digitalization on the growth of socio-economic potential of the territorial system, or to identify its readiness (perception) degree for digital transformation.

In the current study, on the basis of the indicated methodological approach, the author tries to study rural territories' potential, based on characteristics that reflect: 1) availability of rural territories with resources; 2) susceptibility of enterprises (organizations) of territorial system to innovation; 3) possibility of implementing (using) digital technologies in the economy and management, the market potential of which meets the needs of society to form a level and quality of life that meets modern

standards. A comprehensive assessment of rural territories' potential involves, first, the formation of a system of indicators; second, availability and maintenance of information database for calculating indicators; third, a possibility of applying assessments for the purposes of state strategic management.

The author's approved methodology includes five consecutive stages for assessing rural territories' potential. At the first stage, a system of indicators for assessing rural territories' potential is formed using single indicators. At the second stage, the indicators are analyzed in relation to rural territorial entities (the considered municipal district). At the third stage, the values of indicators are differentiated relative to the base levels. The fourth stage involves determination of the weighting coefficients of the values of indicators (according to expert assessments). At the final stage, an integral indicator for assessing rural territories' potential is calculated.

The assessment of rural territories' potential is made according to the totality of its components: 1) social and infrastructural potential (SIP), 2) economic and environmental potential (EEP), 3) digitalization potential (DP). To differentiate values of indicators relative to the base levels, we use the formula:

$$K1_n = \frac{K1_{ij}}{K1_{rf}}, \quad (1)$$

where $K1_n$ – normative value of i -th potential indicator;

$K1_{ij}$ – actual value of I potential indicator of j rural territory;

$K1_{rf}$ – base value of I potential indicator (the regional average value of the indicator is used as the base indicator).

To determine the values of the components' integral indicator of rural territories' potential, the article uses the following formulas:

$$SIP = \sqrt[n]{\prod_{i=1}^n SIP_i}, \quad (2)$$

$$EEP = \sqrt[n]{\prod_{i=1}^n EEP_i}, \quad (3)$$

$$DP = \sqrt[n]{\prod_{i=1}^n DP_i}. \quad (4)$$

Formula for calculating rural territories' potential (RTP):

$$RTP = a_i \cdot SIP + a_i \cdot EEP + a_i \cdot DP, \quad (5)$$

where SIP – social and infrastructural potential;

EEP – economic and ecological potential;

DP – digitalization potential;

a_i – weight factor for a particular i -th potential.

Grouping of rural territories by the level of their potential will be made in the range of the following values: high level of rural territories' potential is more than 0.65, average level – 0.36–0.65 inclusive; low level is less than 0.36.

Using economic and mathematical tools to justify the significance of the selected factors of digitalization potential, we calculated the Pearson pair correlation coefficient which characterizes the relationship tightness between the indicators. T-statistics confirm the significance of the linear correlation coefficient. At the same time, the GDP of a particular entity of the Russian Federation was used as the resulting indicator that characterizes the socio-economic potential. The correlation analysis showed a high close relationship between twelve of the thirty-three factors of digitalization potential which were later included in the assessment. The results confirmed the hypothesis of the study that digitalization potential has a significant impact on the level of territories' socio-economic development.

Judging by the values of correlation coefficients, the greatest influence is exerted by such indicators, presented in descending order, as:

– number of personal computers used for educational purposes, with Internet access, per 100 students (students) in educational institutions (0.86);

– share of fundamentally new technologies in the total number of advanced production technologies developed (0.85);

- share of organizations that implemented technological innovations in the total number of the surveyed organizations (0.81);
- number of fixed broadband Internet subscribers per 100 population (0.76);
- share of organizations that used local area networks in the total number of surveyed organizations (0.74);
- share of organizations that used the ERP systems in the total number of organizations surveyed (0.72);
- number of mobile broadband Internet subscribers per 100 population (0.71);
- share of organizations that had special software tools for managing the procurement of goods (works, services) in the total number of organizations surveyed (0.69);
- share of organizations that received orders for manufactured goods (works, services) via the Internet, in the total number of the surveyed organizations (0.69);
- share of organizations that placed orders for goods (works and services) on the Internet in the total number of the surveyed organizations (0.67);
- share of organizations that used means of protecting information transmitted over global networks in the total number of the surveyed organizations (0.65);
- share of organizations that used CRM systems in the total number of the surveyed organizations (0.65).

Pattern for measuring and evaluating digitalization potential of the territorial system

Digital transformation processes, currently taking place in all spheres of socio-economic activity, are a key component in the organization of effective interaction between business structures, subjects of the scientific and educational community, the state and citizens, thereby creating opportunities for growth and development of territorial system's potential. The nature of the digitalization impact is determined by the capabilities of the entire set of available resources of subjects engaged in digital

transformation, the skills and abilities of its actors in the current and projected periods. We should talk about digitalization potential which is an integral part of territorial system's potential.

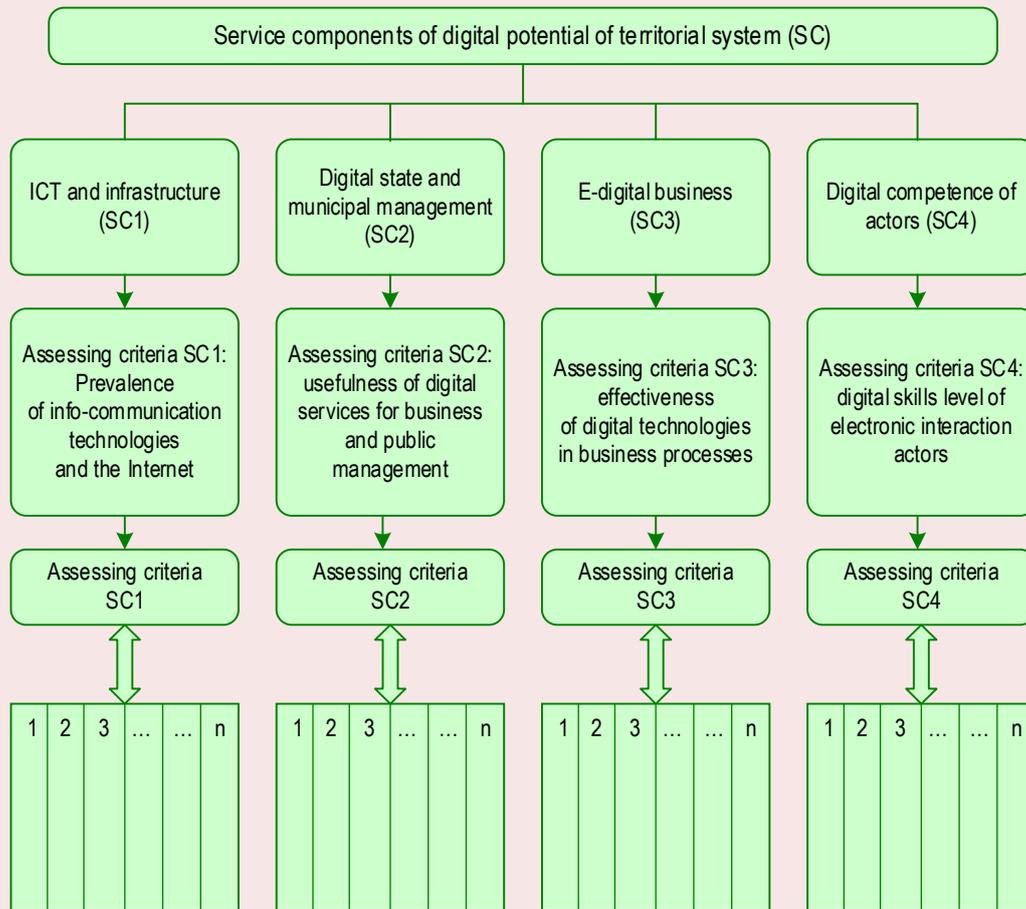
A review of recent scientific publications shows that domestic authors consider digital potential only in relation to industrial enterprises. For instance, N.V. Gorodnova, D.L. Skipin, A.A. Peshkova [38] clearly indicate the unity of three components: 1) resources; 2) company's internal capabilities to implement certain stages of information technology development cycle; 3) functional activity areas in which information technologies can be used. A.V. Kozlov and A.B. Tesli [39] propose to measure digital potential of an industrial enterprise using an integral indicator that reflects the current level and future opportunities for the use of digital technologies by the enterprise taking into account the conditions of external environment. Studies on the assessment of the digitalization potential of national and regional territorial entities remain sporadic (see, for example, [40]), and there are practically no studies on rural territories.

We propose to consider digital potential of territorial education in a general form – as a combined possibility of the available information and communication technologies, scientific, educational and information, and communication infrastructure, as well as the existing skills and abilities of people involved in the digital transformation of processes in all life spheres.

To solve the problems of analyzing and evaluating digital potential, we transform its theoretical formulation into an organizational and functional representation by means of a modular-factor representation (*Fig. 1*).

The assessment uses quantitative and qualitative, financial and non-financial, industry and general economic, absolute and relative indicators which allows expressing explicit and hidden relationships in digital modernization processes at the macro and micro levels, to identify the current state of digitalization potential.

Figure 1. Organizational and functional module for assessing digital potential of territorial system



Source: own calculations.

Table 1. Assessment of rural territories' potential taking into account economic and management digitalization in municipal districts of the Vologda Oblast (as of January 1, 2019)

High potential	Average potential		Low potential
Vologodsky Gryazovetsky Kaduysky Sheksninsky Cherepovetsky	Babayevsky Babushkinsky Velikoustyugsky Verkhovazhsky Vozhegodsky Kirillovsky Kichmengsko-Gorodetsky	Mezhdurechensky Nikolsky Sokolsky Totemsky Ustyuzhensky Kharovsky Chagodoshchensky	Belozersky Vashkinsky Vytegorsky Nyuksensky Syamzhensky Tarnogsky Ust-Kubinsky

Source: own calculations based on Rosstat data and expert assessment.

Taking into account factors of economic and management digitalization the results of level assessment of rural territories' potential are presented in *Table 1*.

We should note that only five municipal districts of the region, or 19.2%, have a high potential level taking into account economic and management

digitalization, seven regions (26.9%) are with low potential, fourteen (53.9%) – medium.

On the basis of the composite index of assessments of the potential and degree of readiness of territorial systems for digitalization, it is possible to structure them in order to plan state support for sustainable rural development.

According to many Russian scientists, territories’ structuring (zoning) is not only a tool for assessing the growth rate (decline) of population’s economy and living standards [41–43], but also a way of proving management decisions made on territories’ development [44; 45].

Based on the obtained data of potential assessing for digitalization of rural territories, we will structure them to determine the digital readiness of territorial system and its digital environment state (Tab. 2).

Further, we will build the matrix “digital readiness level – digital environment of rural territories” (Fig. 2).

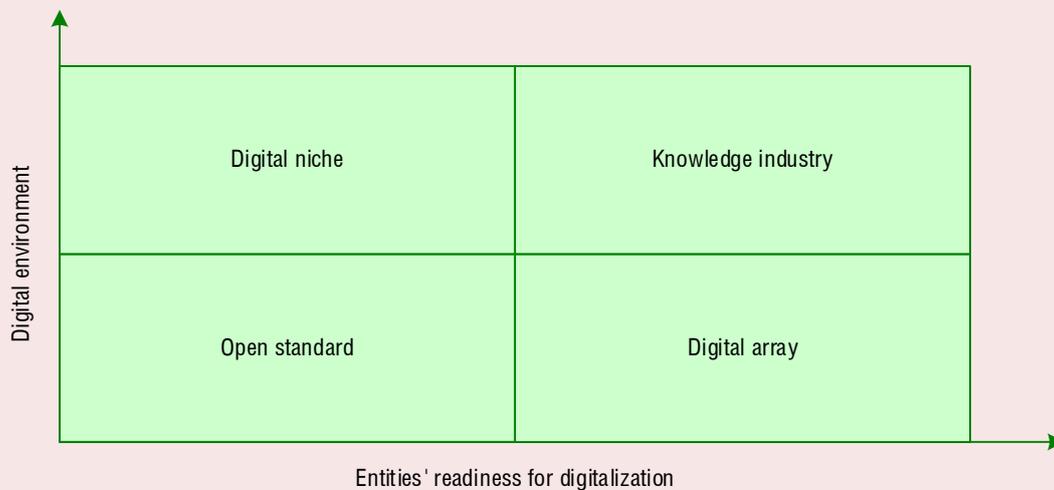
According to classification results, we have identified four rural local digital zones. The “Open Standard” group includes rural territories with a low level of digital environment and entities’ readiness for digitalization. The “Digital Niche” group includes rural territories with high digital environment level and low level of entities’

Table 2. Grouping of rural municipal districts of the Vologda Oblast by level of digital environment formation and readiness for digitalization

		Digital environment formation level		
		Low	Average	High
Digitalization readiness level	High	Sokolsky Gryazovetsky Kaduysky	x	x
	Average	Kirillovsky Totemsky Kichmengsko-Gorodetsky Kharovsky Chagodoshchensky	Vologodsky Cherepovetsky Sheksninsky	x
	Low	Belozersky Vashkinsky Vytegorsky Nyuksensky Syamzhensky Tarnogsky Ust-Kubinsky	Babayevsky Babushkinsky Velikoustyugsky Verkhovazhsky Vozhegodsky Mezhdurechensky Nikolsky Ustyuzhensky	x

Source: own calculations.

Figure 2. Rural digital readiness matrix



Source: own calculations.

readiness for digitalization. The “Digital Array” group covers rural territories with low digital environment level and high level of readiness of subjects for digitalization. The “Knowledge Industry” group represents rural territories with a high level of digital environment and entities' readiness for digitalization. For each rural local digital environment, the matrix allows structuring the corresponding development directions (*Tab. 3*).

Rural territories' classification will help to implement a differentiated approach to making strategic decisions on the distribution of regional financial resources for territories' development.

Digital platform and rural development

According to the foreign scientists [46–49], digital platforms represent a new era and are able to effectively coordinate the interaction between spatially dispersed agents, forming the basic

Table 3. Directions of state regulation and rural development support by types of rural digital environment

Type of rural digital environment (RDE)	Characteristic of digital environment	Forms and directions of state regulation and support for rural digitalization development
Open standard	Rural territories with low readiness degree for digitalization and low digital environment level	<ul style="list-style-type: none"> ✓ Program formation for digital potential development of rural area. ✓ Municipal programs' development for digitalization of rural territories. ✓ Implementation of regional software programs. ✓ Forms' development (opportunities' creation) for entities' remote functioning. ✓ Social and industrial infrastructure development in rural territories. ✓ Digital projects' financing in the “People's budget” program. ✓ Digital potential development of population's though municipal education system. ✓ Expansion of PPP directions in implementation of digitalization tasks.
Digital niche	Rural territories with low readiness degree for digitalization and high digital environment level	<ul style="list-style-type: none"> ✓ Organization of competitions (grants) at the federal level for territories' digitalization. ✓ Organization of competitions (grants) at the regional level for territories' digitalization. ✓ Implementation of regional programs to attract programmers to work in rural territories. ✓ Tax benefits for involved in implementation of digitalization projects at the municipal level. ✓ Search for investors, ideas to enhance the use of territory existing potential. ✓ Organization of competitions (municipal contracts) to search for the effective options of use for land resources. ✓ Grant support to industries for innovative technology production (digital technologies) in production structures.
Digital array	Rural territories with high readiness degree for digitalization and low digital environment level	<ul style="list-style-type: none"> ✓ Creation of pilot digital platforms. ✓ Subsidizing introduction of digital technologies in production. ✓ Digital projects' financing in the “People's budget” program. ✓ Competitions (municipal contracts) to search for the effective use of land resources. ✓ Grant support to industries for innovative technology introduction (digital technologies) in production structures.
Knowledge industry	Rural territories with high readiness degree for digitalization and high digital environment level	<ul style="list-style-type: none"> ✓ Assistance (participation co-financing) in federal programs for digital economic development. ✓ Support for talented young people in rural territories. ✓ Projects' support to develop artificial intelligence and attract scientific research. ✓ Experience popularization of rural development and effective interaction forms with the territories of the “Open standard” group.
Source: own calculations.		

infrastructure of economic and social relations. In its most general form, digital platform is a virtual platform that provides interaction between two (or more) users (user groups) according to certain rules.

According to the departmental project “Digital Agriculture of the Russian Federation”, a digital platform is, first, a group of technologies that are used as a basis for creating a specific and specialized system of digital interaction; second, a breakthrough innovation which is an integrated information system that provides multi-sided user interactions for the exchange of information and values leading to reduction in overall transaction costs, optimization of business processes, and increased efficiency of supply chains of goods and services.

Digital platforms are being actively implemented in both state and industrial structures: a digital platform is being developed to consolidate data from agricultural producers in order to form a general picture of agricultural production, the transition to combines with the Internet of Things modules, GPS/GLONASS systems and unmanned mode capabilities, monitoring the state of arable land from satellite, studying digital traces are being implemented. The Smart Region Program provides for transport sector development based on the data flow from the GLONASS sensors, information about traffic congestion forming an array of big data for solving transport problems.

In the regions, in order to digitally transform agriculture through the use of digital technologies and platform solutions to ensure a technological breakthrough in the agro-industrial complex and achieve productivity growth in “digital” agricultural enterprises, the national platform for digital public management of agriculture “Digital Agriculture” is being implemented which is a digital platform integrated with digital sub-platforms for managing agriculture at the regional and municipal levels.

Due to the development of digital technologies and creation of digital platforms, we propose to form a single digital platform “Rural Territories’

Digitalization” in order to plan sustainable development of rural territories in the context of economic digitalization.

Project digital platform “Rural Territories’ Digitalization” will combine two types of digital platforms (according to the classification, developed by the participants of program implementation of “Digital Economy of the Russian Federation”, led by B.M. Glazkov [50]): infrastructure and applied. The aim of the applied platform nature is to exchange certain economic values in rural territories; and aim of the infrastructural nature is to provide IT servers and information for the authorities to make municipal/regional management decisions.

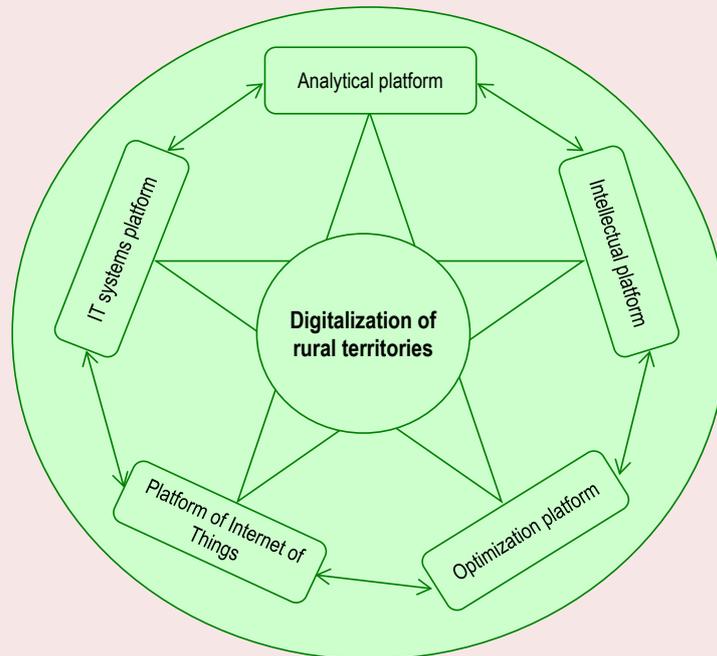
Classic digital platform includes five main blocks: 1) traditional IT systems: data centers and networks that are being upgraded to include a digital platform; 2) interaction with users in digital form; 3) the Internet of Things; 4) analytics, machine learning and artificial intelligence; 5) ecosystems as the basis for interaction in digital world.

Project platform “Digitalization of Rural Territories” provides for the placement of certain information in the context of municipal districts for each rural territory. Using the five-block classical approach to building digital platforms, we will present the project version in the form of a block diagram (*Fig. 3*).

Analytical platform block provides for the placement of such servers as an interactive map of rural territories in real time, data collection in real time, educational programs on digital economy, a database of municipal, regional and federal programs for economic digitalization, a map of the land areas of rural territories with their characteristics, a digital footprint, etc.

Intellectual site block hosts servers for interaction between subjects and users in the digital environment: platforms for goods’ implementation produced in rural settlements, platforms for exchange and evaluation of ideas for territories’

Figure 3. Pattern of information and communication digital platform "Rural Territories' Digitalization"



Source: own compilation.

development, platforms for initiatives for rural territories' development, surveys of rural population, etc.

Optimization platform block is aimed at optimizing processes by combining data from existing platforms for making appropriate calculations and conclusions, for example, combining (integration, information collection) with the national platform "Digital Agriculture", "Rosstat Digital Analytical Platform".

The Internet of Things platform block includes modern digital technologies implemented in rural territories, data on the availability of possible digital technologies for rural territories: monitoring of road congestion, smart greenhouses, GLONASS systems, robotization of production and provision of services to population, medicine at a distance. In other words, the server is aimed at providing smart solutions for agriculture, transport, housing, medicine, education, daily life of local population, etc.

IT systems platform block includes data processing centers for generating forecast estimates (patterns) and scenarios for rural development, visualizing projects of strategic management decisions, calculating rural territories' potential, determining the level of their digital development, generating reports of heads of municipalities and rural settlements, and analyzing digital technologies implemented in the region.

Project platform provides for data integration with national digital public administration platforms that have been created and are currently being implemented.

Information and communication digital platform "Rural Territories' Digitalization" allows displaying in a single digital space all types of resources of the district, directions of their use, investment opportunities and state programs, options for applying the project approach. All platform information is formed in certain folders with demonstration of video image, for instance,

a certain resource, in real time, quantitative resource support indicating the possibilities of its growth and use at the moment, broken down by each rural territory of the district. To expand the platform's capabilities, it is filled with ideas and proposals from the rural population, representatives of government authorities, and investors interested in investing in these territories, development plans, projects implemented in the district with results for the current date, state and regional programs, and online calculators. Platform capabilities include online meetings and discussions, and decision-making. So, when selecting a specific tab, the platform reveals all types of resources, and then, for each type of resource in more detail, allows using the available potential for calculating planned values. The platform advantages are information openness and accessibility, single database (district potential, its use options, reporting of the heads of rural territories, development plans and forecasts), automation of the calculation of indicators, relationship of all factors of rural development in planning attracting investment, possibility of combining small projects in municipal programs.

Developed version of digital platform will serve as the basis for the use of rural development planning mechanism.

Conclusion

Exploration of the essence of the "digitalization" concept has shown that the scientific literature and management practice have not yet developed a complete understanding of it as a type of formed sphere of knowledge in economic theory and practice. The diversity of points of view on understanding the essence of digitalization stems from the many approaches of modern scientists to the content of the "digital economy" definition which is largely based on the use of digital technologies, but their penetration is not limited to the space of economic relations and involves their application in all human life spheres in the interests of increasing the level and quality of population'

life ensuring national security and country's sovereignty. For the purposes of our research, territorial system's digitalization is understood as the process of promoting digital technologies in the socio-economic environment of its functioning and in the management of life sphere for effective use of its subjects' potential, creating modern jobs and comfortable living conditions for people, sustainable economic growth, and improving population's living standards.

Active use of digital technologies, starting with the IT sector, acts as a driver of socio-economic development accompanied, according to analysts, by positive (reducing unit costs for production, creating prerequisites for economic growth and improving the quality of services) and negative (increasing threats to information security and job cuts, increasing inequality) effects that require analysis and evaluation.

The applied methods of analyzing digitalization processes allow expressing its functional content and subject-target orientation of influence tools in a certain period, but are not able to display systematically the influence and effectiveness of multi-level spatial set of factors that characterize the state of digital transformation of life spheres and dynamics of changes occurring in digital environment of the country and its regions. This implies the need to improve theoretical and methodological tools for analysis and comparable assessments of the state, development and effectiveness of the promotion of digital technologies in management, social and business processes.

As a result of the review of scientific research materials related to digitalization problem, in general, we can argue that digital transformation of interaction processes in the socio-economic territorial system forms, through penetration of digital technologies, opportunities to increase economic competitiveness, increase the level and quality of population's life, contributes to

the creation of new products and services (or their digital forms) and, in this way, acts as a structural formation element of a new level of territorial system's potential. Covering production subsystems (resources, equipment, transport and logistics and marketing modules), a complex of industries of production and social infrastructure, as well as organization and management process, digitalization is a new potential component of the territorial and spatial system. Moreover, as observations show, the processes of digital transformation, currently taking place in all spheres of socio-economic activity, are becoming a key component in effective interaction management between business structures, subjects of the scientific and educational community, the state and citizens, thereby creating opportunities for growth and development of the territorial system's potential. The nature of digitalization impact is determined by capabilities of the entire set of available resources of subjects engaged in digital transformation, skills, and abilities of its actors in the current and projected periods.

A review of recent scientific publications shows that domestic authors consider digital potential only in relation to industrial enterprises. Studies on the assessment of digitalization potential of national and regional territorial entities remain isolated, and there are no studies on rural territories.

In the current study, we propose to consider digital potential of territorial education in general as combined possibility of existing information and communication technologies, scientific, educational and information and communication infrastructure, as well as the existing skills and abilities of people, involved in digital transformation of processes in all life spheres. The article transforms this theoretical formulation into organizational and functional representation by means of its module-factor representation for solving analysis problems and digital potential evaluation.

Using economic and mathematical tools, designed to justify the importance of the selected factors of digitalization potential, we have calculated the Pearson pair correlation coefficient. It has showed a high close relationship between *twelve of the thirty three* factors of digitalization potential in Russia's regions. As a result, the paper confirms the accepted hypothesis of the research that digitalization potential significantly affects socio-economic development level of the territorial system.

In the course of the study, the author has grouped the Vologda Oblast rural municipal districts according to the formation level of digital environment and readiness for digitalization, has assessed the potential of the Vologda Oblast rural municipal districts taking into account economic and management digitalization (as of January 1, 2020), has constructed a matrix that reflects the dependence "digital readiness level – digital environment of rural territories". The research has identified the directions of the state regulation and support for rural territories' development in relation to the types of rural digital environment, and has proposed the pattern of information and communication digital platform "Rural Territories' Digitalization".

The pattern made it possible to create digitalization profile and structure a set of directions of digital transformation of life sphere subjects, as well as to express the nature of changes in the digital landscape over a certain period. Thereby, it becomes possible to form a multi-level set of indicators for comparable assessment of the state and dynamics of digital transformation development, to improve the analytical base for developing options for setting priorities when justifying strategic decisions in the field of digitalization.

Thus, in relation to the regional level, development and test of methods for the integrative assessment of digital transformation of processes in the field of production, exchange, distribution, and

consumption of public products make a certain contribution to the development of methodological approaches to assessing territorial systems' potential in the context of economic digitalization. However, we have to state that there is still no active orientation of the methodological tools to the tasks of studying the interdependence of the processes of digital transformation and the potential state of national and regional socio-economic systems which makes it necessary to carry out further research in the chosen field of scientific research.

Practical significance of the work is to use the assessment results of rural territories' potential in making management decisions at the municipal and regional levels in order to develop territorial systems, budget resources planning in the format of using project management and digital platforms for collecting information, making forecast calculations, establishing mechanisms of interaction in the "business – government – population" chain and forming competitive advantages of rural territories.

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Received December 29, 2020.