The impact of the digital divide on the development of socio-economic systems

A L Popova¹, P A Nuttunen¹, M V Kanavtsev² and V A Serditov²

¹Department of municipal management and social technology, St. Petersburg State Agrarian University, Highway House 2 Pushkin, St. Petersburg 196601 Russian Federation
²Department of program and target management in instrument engineering, St. Petersburg State University of Aerospace Instrumentation, 67 Bolshaya Morskaia Street, St. Petersburg 190000 Russian Federation

E-mail: serditov@center-si.com

Abstract. The article presents studies of the impact of digital inequality on the development of rural areas as socio-economic systems. The difference in the levels of socio-economic development of rural areas and cities in the transition to the information society is not smoothed, but rather increases, which threatens to turn most of the territory of the Russian Federation into one huge depressed region. Among the key factors determining the negative impact of digital transformations, the study highlights the rapid deterioration of the quality of human resources, which is a consequence and cause of digital inequality. The process of concentration of innovative potential in large cities and individual industries, which leads to the depletion of rural areas, and unpredictable transformations in agriculture, where the lack of mass application of high technologies leads to a sharp decrease in efficiency and General degradation of a number of resources, is critically comprehended. To solve this problem, the authors propose the concept of information model of digital transformation of management processes of socio-economic systems, taking into account the influence of territorial and sectoral factors of formation of resource potential of rural areas in the information society.

1. Introduction

Processes of digitalization of social and economic systems become the main subject of researches in the different fields of science. So, the number of the scientific publications devoted to questions of digital economy in the leading scientometric databases, increased from 5 in 1996 to 336 in 2017 [1]. It is possible to select two basic approaches to the concept "digital economy". The first, presented in a significant amount of works of both the western, and Russian authors, considers the information economy as the structure based on the global market of information and communication technologies, but saving the basic principles of development of economy of industrial type [2-4]. The second approach is based on situation that information economy is essentially new form of the organization of activity [5-7]. Supporters of both approaches recognize that digitalization is a global process that creates both new opportunities and new challenges for humanity [8-10]. Social and economic risks associated with digital technology are taken into account in the development strategies of most modern states [11]. For example, the Russian Federation is implementing a national programme "Digital Economy of the Russian Federation" calculated until 2024. The implementation of the Digital
Agriculture project has been calculated in the agro-industrial complex for the same period. The called strategy consider that transition to information society and digital economy brings additional conditions and restrictions in developments of territories [12]. The following system of indicators is used by the Ministry of Agriculture of the Russian Federation to assess the level of digitalization of the agro-industrial complex of the regions:
- Testing of pilot solutions and their replication;
- Full functional application of E-Government;
- Introduction and testing of new digital technologies;
- Amendments to regulations aimed at the implementation of the departmental project Digital Agriculture;
- Unification and application of centralized solutions;
- Opportunities to integrate existing regional systems into agricultural processes.

According to the results of the survey conducted in 2018, 20% of 85 subjects of the Russian Federation have a high level of IT development and introduction of modern technological solutions in the agro-industrial complex, 29% of regions record the average level of this indicator [13].

In addition to differences in the level of digitalization of individual regions and sectors of the economy, digital inequality is becoming a significant social and economic phenomenon for the development of the digital economy. In conditions of digital inequality for a part of the population (social group) there is no or limited access to information resources [14]. As a result, the social opportunities of members of this group are limited, which negatively affects the economic efficiency of public production, the development and preservation of culture and the level of education of the population. There are new social risks associated with digital inequality: "The global trend is that the information economy connects those who value it (thereby giving it added value) to its network, but disables those who have no value for it (thereby further reducing their chances of gaining some value)" [15].

Today, the main causes of digital inequality can be grouped into three groups: technical, economic and social. The named groups are not isolated from each other, on the contrary, the factors included in them are closely related and mutually agreed.

Given the current level of information technology development, in most cases it is economic factors that should be seen as key in addressing digital inequality and should be primarily targeted by regulatory influences from the State and other social institutions. [16] The need to reduce the influence of economic factors that exacerbate digital inequality links the latter to the problems of economic growth and socio-economic development. The lagging of certain territories in the development of information and communication infrastructure, the unavailability of modern digital technologies to the population due to the lack of education necessary for their development, the impossibility of full participation of agricultural producers in the creation and use of specialized information resources are only private cases of digital inequality [17]. Systemic in nature, the problem of digital inequality affects all components of the resource potential of territory development and requires an integrated solution.

The purpose of the work is to carry out an assessment of the resource potential of the territories of the Russian Federation (primarily inequality of development of rural and urban areas) and the degree of slowdown of the rate of socio-economic development in the territories remote from megacities. The research challenge is also to prove that the problem of digital inequality is socio-economic rather than purely technical. And the solution of this problem requires the development of a system of adaptation of the process of development of the territories of the Russian Federation to the conditions of the digital economy.

2. Research materials
The ongoing transformation processes are associated with the transition of the Russian economy to the sixth technological stage. This way of life assumes an increase in the speed and volume of data and information affecting the system "man-machine-environment", digitalization, penetrating all spheres
of human life, changes in the principles of building information and logistics links, personnel policy, the implementation of operational tasks and technological solutions in all production systems [18]. The existing fifth and beginning sixth technological mode is characterized by an increase in the volume of information and complication of processes taking place in the world, which leads to an increase in requirements for the quality of management activities [14]. Remote forms of labor activity are actively distributed and the spatial availability of certain types of resources increases due to the introduction of information and telecommunication technologies [19]. However, significant intraregional differences in the level of social and economic development remain, including the fact that a significant part of the population in rural areas lags behind the standard of living in urban areas. In combination with the high share of low-productivity and low-tech industries in the structure of the agrarian economy and low level of entrepreneurial activity in rural areas, the gap in the levels of socio-economic development leads to an increase in the digital inequality between urban and rural areas and accelerate the degradation of the resource potential of rural areas.

The role of rural areas in the economy of the Russian Federation has been transformed since the 1990s under the influence of changes in the structure of the economy, the conditions of international trade and scientific and technological development. Scientific, scientific, technical and innovation activities are concentrated in large and major urban agglomerations. Agricultural production is concentrated in the areas with the most favorable agro-climatic and soil conditions and a favorable position in relation to the capacious consumer markets. As a result, for several decades, there has been a steady decline in the population of rural areas of the Russian Federation [20]. The exception is only a part of the southern regions of the European part of Russia and the territory included in the large urban agglomerations. In the conditions of existing technological lag of the Russian agriculture from the most developed in this sphere of the states the reduction of labor resources negatively affects the general resource potential of social and economic development of rural areas and competitiveness of Russian agricultural producers in the international markets of resources and products.

According to the All-Russian population census conducted in 2010 Rosstat published the ratio of citizens to rural residents in Russia, which was 74% and 26%, respectively. Russians live in 2,000 386 cities and towns of urban type and 134,000 villages and villages. At the same time in 2002 Rural settlements were 8.5 thousand more, that is, the Russian village is dying out [21].

Before examining the impact of digital inequality on the development of socio-economic systems and, in particular, the resource potential of their development, let us clarify the meaning of the concept of "resource potential". Interpretations of the term "resource potential" range from the concept of it as a purely quantitative assessment of the totality of resources to its definition as a basic element of the production process, which has both quantitative and qualitative characteristics. The second one is more complete and interesting from the point of view of the modern theory of management of social and economic processes. Considering the resource potential as an element of the dynamic process, it is possible: avoid strict territorial binding when determining the resource potential, which is very important in terms of activation of integration processes in socio-economic systems; to take into account not only quantitative, but also qualitative changes of resources in the process of their use; evaluate the prospects of involving new external resources, as well as the creation of internal resources within the production process.

Also, this aspect of the concept of "resource potential" allows us to refer it to any socio-economic process, including the process of development of industries or territories. The resource potential of the processes of development of large systems is difficult to estimate quantitatively because of the incommensurability of various types of resources: land, labor and material. The theoretical basis for their comparison is the concept of interchangeability of different types of resources in the process of production: the variety of different types of resources creates conditions for their partial interchangeability [22].

In traditional Marxist theory, only land, labor and capital are recognized as basic economic resources. Other components of the production process, primarily technology, are considered as methods and means of influencing the resources. For example, the division of the components of the
resource potential into tangible and intangible ones assumes that the tangible component in its essence is the main economic resources, albeit in a slightly modified composition, and the intangible potential is the methods and means of impact on resources.

The most important elements of the resource potential of the development of territorial socio-economic systems in modern conditions include: information, human, financial and natural-ecological resources.

The advantage of information resources and knowledge systems is their absolute mobility - the possibility of moving resources of this type is not limited neither by territories nor by the costs of relocation. Human resources are less mobile and their ability to move is limited by social and other conditions. Financial resources are quite mobile, but their possible displacement is limited by certain economic and political relationships. Most environmental resources cannot be relocated.

In addition to spatial mobility, resources have different capacities for development. In this context, the ability to develop is understood as the speed of possible quantitative and qualitative changes in the resource corresponding to the objectives of management orientation under the influence of external and internal factors in relation to the object of management. The maximum ability to develop has information resources, the minimum - natural and environmental [15].

Thus, it is advisable to consider human resources as basic in modern conditions, as their management provides competitiveness and accelerated development of socio-economic systems. Achieving the integrity and situational sustainability of the development of the basic resource potential of the territory is ensured by the development of its human potential, capable of implementing the "growth strategy". The implementation of the "growth strategy" is ensured by transferring the center of gravity in the structure of resource elements from material to intangible (human capital, information, new knowledge, inventions, etc.). Unfortunately, there is currently a rapid decline in the human potential of rural areas of the Russian Federation, which makes it difficult to implement their development programs.

Information resources are a kind of meta-resources. The term "meta-resource" began to be used relatively recently in the context of networked information technologies. This term refers to information resources containing links to other electronic resources (catalogues, lists, portals, etc.). That is, a meta-resource is a resource that provides access to other resources. The applicability of this term to information resources as part of the resource potential of socio-economic systems is due to the fact that today information allows you to access the flow of traditional resources, change and redirect them. In turn, the lack of access to information resources actually means that it is impossible for individual subjects, including social institutions, to influence the processes of formation of resource potential and development of socio-economic system. Targeted elimination of the digital divide at all stages of work with information from its generation to the evaluation of the results of its use will make it possible to distribute other resources in accordance with the principles of sustainable development of territorial socio-economic systems.

According to Speedtest Intelligence, Russia takes the 42nd place (between Slovenia and Chile) on the average speed of loading of the fixed broadband Internet. On the average speed of return the country takes the 16th place, between Reunion and the Netherlands.

By results of more than 24 million testings of the fixed broadband Internet in the I quarter 2018 the average speed of loading across Russia was 38.09 Mbps. Average speed of return was 37.76 Mbps. Eastern Europe, including Russia, occupies the 4 place in the penetration of the Internet - 80% of the population of the region are connected to the network [23].

Systematic study and assessment of the resource potential of socio-economic systems, development and implementation of new mechanisms of complex impact on their resource potential are extremely important in addressing the problems of rural areas. Preservation and revival of the resource potential of rural areas, as one of the main components of the national heritage, are possible through the introduction of innovative high-tech production technologies, including agricultural, but require a revision of basic approaches to managing the development of the resource potential of the region. At the same time, the current and expected state of slow-moving resources should be taken into account
as much as possible, as their quantity and quality have a significant impact on the development of the territories. Ideally, the most rational schemes for the use of various types of resources, both own and involved, should be developed.

The degradation of the resource potential of rural areas due to digital inequality is currently difficult to assess. The system of indicators recorded by the state statistics authorities of the Russian Federation was developed for the industrial economy and does not allow to track the impact of digitalization processes on socio-economic systems [24]. Therefore, the only way to assess the impact of digital inequality on the development of territories is to measure the indirect results of informatization, manifested in changes in the efficiency of governance and stabilization of the social situation.

A possible solution to this problem is the development of information systems, or more precisely, the creation of a new type of information system, which makes it possible to conduct momentary slices of the main parameters of resource potential, with a developed heuristic apparatus, necessary for the timely identification of changes in the composition of resources and in the nature of the links between them. This will require a change in the methodology for assessing resource potential, moving towards a systematic review of resources and their impact.

3. Results and discussion
The need for a digital transformation process requires substantial free capital reserves, cheap long-term loans and dynamically adaptable training programs for personnel (both management and production). Overcoming the digital divide implies, along with the implementation of a set of organizational and technical measures to create information and communication systems, the assessment of the degree of adaptation of individual enterprises and municipal areas to the consequences of the introduction of elements of the digital economy.

Among the main negative effects of digital transformations on the development of territories, we highlight the following:
- unwillingness of the administrative apparatus to adapt to modern management methods with the use of innovative digital solutions;
- absence of clear measures to support medium, small and large businesses in solving the problem of digital inequality in the state programs of territorial development of the digitalization cluster;
- infrastructural inequality of territories and significant delay in implementation of software and hardware solutions compared to technologically developed countries;
- absence of redundant human resources potential with sufficient and advanced level of competencies, striving to work in the territories with the purpose of their real development, rather than their own enrichment.

Regardless of who initiates the digital transformation: commercial organizations, the state or other social institutions, their implementation should take into account the risks of increasing digital inequality in society. In parallel with digital transformation, programmes of action should be developed and implemented to reduce the digital divide. The level of effectiveness of such programmes can be considered as the improvement of the quality of life and activities of the population in the information society. That is, the main effect of measures to reduce digital inequality in the context of the development of socio-economic systems is an indirect effect, which is manifested, for example, in the increase in the productivity of public works, increase in the speed and scale of innovation, the growth of returns per unit of natural and environmental resources, etc.

Algorithm "field → counter", developed and used in the framework of the departmental program Digital agriculture should lead to the creation of reference digital models of production processes in agriculture. Availability of these models should make it possible to increase the efficiency of business of agricultural producers, but it will not be enough. For real growth of indicators, universal open systems of agricultural production management are needed with hundreds of input parameters and analysis of big data with AI elements, which includes the formation and algorithmization of control scenarios for machinery, devices, things, processes, finance.
The problem is that the existing methods of planning the development of socio-economic systems do not take into account such strategic aspects of digital transformation as digital inequality. Traditional planning in general does not take into account the social factor of formation of the resource potential of systems development.

Reliability of the assessment of the impact of digital inequality on the development of territories is largely determined by the volume, structure and balance of the system of indicators and indicators used to track the progress of development. The systems of indicators currently used to address the challenges of rural development management mainly contain indicators that characterize only quantitative parameters and cannot be used to track the systemic links between different socio-economic processes and phenomena, and therefore to assess the impact of digital inequality.

Usually one of the two main approaches is used in the construction of indicator systems: the development of indicator tables or the construction of integral indices. Tables allow for a separate assessment of various parameters of the socio-economic system of the territory with the necessary degree of detail, integral indices are convenient for comparison of different systems. At the same time, the main drawback of the tables of indicators is their cumbersomeness, which is especially noticeable during the comparative analysis, while more compact integrated indices often turn out to be insufficiently informative due to inadequate aggregation of the evaluated parameters of the system and arbitrariness in assigning their weights.

To solve the problems of assessing the impact of digital inequality on the development of socio-economic systems, it is preferable to use systems of indicators built in the form of tables of indicators, grouped by type and conditions of impact, because in this case it is possible to analyze the relationship between indicators from different groups.

The main task in developing the tables of indicators is to form a list of assessed parameters of the system development and their grouping, which is valid from the point of view of management. Since the digital inequality is the result of digital transformations, the model of indicators proposed by Sheldon and Land can be used as the basis for the developed table of indicators to assess the main elements of the functional system of a changing society. The Sheldon-Land model distinguishes five groups of indicators: socio-economic well-being; social participation and exclusion; time use; consumer behavior; claims, satisfaction, approval, and morale [25].

Taking into account the specifics of the problem to be solved, the Sheldon-Land model can be modified as follows: indicators of social and economic well-being (gross product, average per capita income, level of employment of the population as a whole and individual social groups, productivity by industry and field of activity); indicators of information activity of different groups of the population (the number of requests in information systems, the volume of information posted, the share of original information in the total volume of information posted, provided with It is also advisable to include in the system of indicators objective statistical data characterizing the main spheres of life of modern society: political, economic, social, spiritual and moral [26]. The obvious problems of the use of this model in mass research are the significant labor intensity of primary data collection and the prevalence of individual subjective assessments in the array of indicators.

The problem of measuring the impact of digital inequality on the development of territories is due to the complexity of the socio-economic system of the territory as an object of management. The development of the territory is multidimensional in nature, as it combines subjective and objective characteristics, as well as micro and macro parameters. Accordingly, to form a complete picture of the current socio-economic situation and conclusions about the degree of impact on the development of the digital inequality is not enough to assess the objective characteristics of the territorial system, recorded by the statistics, it is also necessary to determine and fix the attitude to the situation of individuals and social groups.

It is also important to establish a distinction between the direct and indirect impact of the digital divide on the development of the territory. If direct effect indicators are mainly quantitative characteristics of conditions and intensity of social and economic processes, indirect effect indicators are qualitative characteristics of the processes taking place, allowing to draw conclusions about the
degree of achievement of social and economic development goals. In addition, it should be remembered that the nature and speed of development of the territory depends on the amount of economic resources at the disposal of the local community: human potential, established economic relations, advantages of geographical location, etc.

It is generally accepted that the elimination of the digital divide leads not only to qualitative improvement, but also to quantitative growth of development resources, but this process is not always accompanied by improvement of the real living conditions of all social groups, let alone individuals. Thus, along with the positive, the elimination of the digital divide can have a negative effect. For example, the possibility of destabilisation of socio-economic systems in a rapidly transforming digital environment is a cause for concern, including as a result of the emergence of a large number of unorganised information flows in society, which will involve a significant proportion of production resources. In addition, experts note that the availability of information does not always lead to the improvement of human resources.

The problem of taking into account in the system of indicators of possible positive and negative effects for an individual or a social group (micro level) and society as a whole (macro level) in the case of the population of rural areas acquires special importance. It is obvious that for the purposes of macroanalysis, the entire rural population of the Russian Federation can be considered as a separate social group. But at the same time, residents of a particular settlement have a unique potential to respond to changes in the information resources of the territory, which should be assessed and taken into account when making decisions related to the development of the territorial and socio-economic system.

The relationship between the conditions for the development of society at the macro level and the micro level of change in the quality of life of the rural population in the system of indicators can be established by comparing the ongoing social changes with the goals of socio-economic development of rural areas, as defined in the document "Strategy for Sustainable Development of Rural Areas of the Russian Federation for the period up to 2030" [27]. The latter is essential if the state is to maintain its role as the main initiator of digital transformation, but it should also be taken into account by all other participants in the process.

The methodology for building a system of indicators to assess the impact of digital inequality on the development of socio-economic systems should be based on the following general principles:

- a balanced combination of objective and subjective data;
- separation of indicators characterizing the direct and indirect effect on the population as a whole and individual social groups;
- establishing the connection between the effects manifested at the micro level (individual, social group) and macro level (society as a whole);
- mandatory fixation of quantitative and qualitative characteristics of the socio-economic system of the territory at different stages of the development process.

The system of indicators to assess the impact of digital inequality on the development of socio-economic systems should contain indicators of various functional types, as only if this condition is met can it be possible to obtain a reliable assessment of the current situation, taking into account its multi-dimensionality.

4. Conclusions
As a result of digital transformations, new technological patterns based on mass use of advanced information technologies, computer facilities and telecommunications, and the leading role of information and communication infrastructure in the system of public production are becoming dominant in the economy of the territorial system. The process of digital transformation gives people and their groups access to a variety of sources of information, relieves them of routine work, ensures high efficiency of material resources use. At the same time, the production itself changes - its product becomes more "information-intensive".
Specialized infrastructure of production and provision of information services in all areas of economic and social life is being formed. This creates new opportunities for improving economic well-being and social development, while reducing the burden on the environment. The inconveniences associated with living in rural areas and peripherality can be eliminated through high-quality communications. Virtual jobs remove geographical constraints, and jobs and activities lose their close dependence on the place of residence. However, modern society cannot ensure the uniform development of information infrastructure throughout the country and equal access to information and information technologies for all social groups and strata of the population. Information (digital) inequality is emerging. The impact of digital inequality on the development of social and economic systems in the short and medium term is ambiguous and not always expressed. Nevertheless, being a meta-resource, information determines the possibility of correct assessment, relocation and qualitative improvement of traditional resources of socio-economic systems development: labor, capital and land. Therefore, in the long run, digital inequality is likely to manifest itself in serious imbalances in the development of the resource potential of territories and slowdown in the pace of socio-economic development.

The problem of digital inequality is of a social rather than a technical nature. Therefore, social acceptability and compliance with people's needs should be a necessary condition for its resolution. The most significant impact of digital inequality in the transfer of properties and disproportions that have developed in depressed areas during the period of industrial development, in the conditions of the information society. Therefore, it is important to develop as soon as possible a system of adaptation of the process of development of the territories of the Russian Federation to the conditions of the digital economy. In particular, it is necessary to group regions, districts and enterprises depending on the efficiency of the organization of activities and infrastructure readiness for development in the information economy, to determine, in accordance with the analysis, the size of the groups and the degree of support required. It is also necessary to develop an information model of digital transformation for both regions and individual sectors of the agro-industrial complex, defining the role and functions of the state in the process of transformation and subsequent functioning of the economy in the new conditions.

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