

On the Impact of Digital and Financial Literacy on the Homogeneity of the Russian Federation Economic Space. Analysis Attempt

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Abstract—It is determined here, based on the study of theoretical aspects of the heterogeneity problem of the Russian Federation and research materials on this topic, that the country's economic space homogeneity can be provided by functionally literate people, in particular, the population with a high level of digital and financial literacy. The purpose of this study is to analyze the impact of the financial and digital literacy level of the population on the economic space homogeneity of the Russian Federation. The research methodology includes a formal logical method, an aggregation method, a ranking method, and statistical analysis methods. In this paper, the differentiation of Russian regions by the socio-economic development level, the financial and digital literacy level is illustrated by rating tables. The hypothesis of the relationship between the integral indicators of financial literacy, digital literacy and the aggregate estimated indicator of heterogeneity of the economic space is tested. The calculations results showed that at present, the increase of the financial literacy level has a direct positive impact on the indicators that characterize the socio-economic situation of the regions, while the expected similar conclusion regarding the digital literacy indicator is not statistically confirmed. Possible reasons for this fact are analyzed. The conclusions formulated in this paper can be used in the development of activities within the framework of Federal target programs, regional development programs.

Keywords—heterogeneity of the economic space, digital literacy, financial literacy, correlation.

I. INTRODUCTION

The economic space of the Russian Federation is rather heterogeneous. The heterogeneity of the country's economic space is caused by objective factors: geographical location, natural and climatic features of the territories, the presence (or absence) of natural resources. These factors determine the characteristics of the reproduction process, individual for each region. The development of the economy and its

interdependence with the environmental, social, and technological aspects of society make the heterogeneity problem even worse.

As rightly noted, "... the result of the intensive development of regional developments (for mainly applied developments) over the past decade is that there is no longer need to prove the requirement to identify and take into account the spatial factor in the Russian economy" [1].

Even in 2008, such a problem as a high level of social inequality and regional differentiation was recognized at the state level as one of the main social and institutional problems that affect socio-economic processes in Russia [2].

At the same time, the difference in economic performance between regions within countries is a global problem that impedes inclusive growth and economic integration, generates discontent and undermines trust and cohesion in society [3].

Many scientists consider the solution to the heterogeneity problem of the economic space in building a new innovative and socially-oriented model based on the cluster-network structure [4, 5, 6]. However, all projects currently being implemented in Russia to create innovative territorial clusters are pilot projects, and approaches to strategic planning of spatial development of the Russian Federation are still implemented within the framework of goal-setting on the territorial principle [7].

The spatial development strategy of the Russian Federation for the period up to 2025 defines the following goals [7]:

- sustainable and balanced spatial development of the Russian Federation ensuring, aimed at interregional

differences reducing in the population level and quality of life

- economic growth and technological development acceleration
- ensuring the national security of the state.

In this context, the population is an object that is targeted by state regional economic policy measures. On the other hand, the population, as an element of the economic space, becomes a subject that determines not only the spatial distribution of factors of production, but also the nature, scale, and dynamics of the development of socio-economic complexes of regions. Interacting with other elements of the economic space, people in the process of meeting their needs create conditions for the sustainable functioning of the economic space and its development. Human capital is considered as the most important tool for improving the well-being and competitiveness of an individual and society as a whole, since today the country's well-being is primarily increased by its intellectual potential [8].

Therefore, equitable is the claim that the solution to the problem of heterogeneity of economic space is, in particular, in the task of "...the impact on the economic behavior of microeconomic agents in order to create such a spatial distribution of values of micro- and macroeconomic parameters ... in which the objectively conditioned decisions of microeconomic agents will correspond to the equilibrium values of macroeconomic and "regional economic equilibrium" [1]. To make effective decisions, people, as microeconomic agents, must have knowledge, skills and competencies that correspond to the current level of development of society, as well as improve their quality by following changes in the external environment — technological, market, and information. Each participant in the production process should not only act as a qualified user, but also look for fundamentally new technical, economic, and organizational solutions [9].

Considering the above, it seems that the homogeneity of the country's economic space can be ensured by functionally literate people whose competencies will reduce the scale of differentiation of socio-economic development. Relying on human capital, it is possible to significantly overcome inter-regional differences caused by objective factors of uneven development of territories. This assumption is verified in this paper by establishing a correlation between the digital and financial literacy of the population of the Russian Federation and indicators that characterize the heterogeneity of the country's economic space.

II. METHODS

General scientific methods of analysis and synthesis were used as research tools, as well as specific research methods such as: a formal logical method, an aggregation method, a ranking method, and statistical analysis methods.

III. MAIN PART

The problem of the economic space heterogeneity of the Russian Federation and its negative impact on the socio-economic development of its territories has been identified for a long time. The achievement of such effects as increasing the satisfaction of the adult population with the quality of their life, strengthening social stability, additional investment attractiveness of territories, and increasing the

competitiveness of the adult population is ensured, in particular, by the level of human and social capital increasing and functional literacy forming [10].

According to the UNESCO definition (1978), "a person is functionally literate if he can perform any activity in which literacy is necessary for the effective functioning of his group or community and allows him to use reading, writing or counting for his own development or for the development of his community". However, the processes of transformation of the economy and society under the influence of globalization, digitalization and innovation are changing the requirements for functional literacy.

The choice of functional literacy components such as digital literacy and financial literacy for the research is based on the following.

Rational use of financial resources, including personal savings, understanding of the offer on the market of financial services, informed (understanding consequences) application of the financial instruments offered by the market contribute to improvement of financial well-being and is achieved through financial literacy. Financial literacy is the result of the process of financial education, which is defined as a combination of awareness, knowledge, skills, and behavioral patterns necessary for making successful financial decisions and ultimately achieving financial well-being [11]. Financial literacy is also understood as competence in financial matters that allows you to carry out financial planning, control your personal budget, make an informed choice of financial products and services, taking into account the available opportunities and risks, the ability to seek help and advice from specialists, and take other effective measures to improve financial well-being and protection [12].

In [13], based on the results of generalization of opinions existing in the economic literature, it is concluded that a low or zero level of financial literacy leads to negative consequences for society, the state, business and consumers of financial services. In particular, for the state, low financial literacy limits the opportunities and reduces the effectiveness of regulating financial markets, protecting consumer rights, and hinders the transition to a pension system based on greater individual participation. The inability of a person to make informed financial decisions and manage personal finances creates risks for the banking and financial system of the state, provokes social tension in society, restricts the consumption of financial services, and leads to restrictions on savings and investments.

The relevance of the problem of financial literacy of the population, due to the large-scale influence of this factor on the development of the national economy, the financial market and the well-being of citizens, is reflected in a large number of methodological approaches to calculating indicators of financial literacy, most of which are based on subjective assessments of respondents' level of their literacy during testing [14].

Theoretical conclusions about the impact of financial literacy on the development of individual segments of the financial market are confirmed empirically in a number of works [15, 16].

Currently, most of the financial products and services belong to the digital environment, and the largest number of digital resources and services that a person directly relates to

in everyday life has been formed in the sphere of economic relations. The Internet has transformed economic and social interaction; artificial intelligence overcomes industry and territorial barriers, and changes consumer behavior. «The digital revolution adds new layers to the material cultures of financial(ised) inclusion, offering the state new ways of expanding the inclusion of the 'legible', and global finance new forms of 'profiling' poor households into generators of financial assets» [17]. Therefore, it is obvious that the effective solution of socio-economic problems in the modern world requires digital literacy.

In the context of digitalization of public relations digital literacy can be defined as the instruments through which is accomplished the acquisition of important life skills for the implementation of any activities as key components of digital literacy of the person are determined as follows [18]:

- information literacy as the skills for creating queries, search and retrieval of digital information, working with different types of data and assessment of the relevance of the source and its content in a network;
- communication literacy, as the ability to interact, communicate and collaborate using digital technologies, to comply with the norms of communication in the network;
- creating digital content as a competence for creating and editing digital content, while understanding how copyright and licenses should be applied;
- digital security as skills to protect devices, content, personal data, and privacy in a digital environment, as well as understanding the impact that digital technologies have on social well-being, social inclusion, and the environment;
- solving problems in the digital environment, such as skills in using mobile applications and computer programs to perform everyday tasks, constantly expanding knowledge in the field of digital technologies, and the ability to solve hardware and software problems.

A study conducted back in 2012 by The Institute for the development of the information society (with the support of Microsoft Corp) examined the impact of ICT competencies as a component of Russia's human capital on the innovative development of the economy and social sphere. The study showed that "ICT knowledge and skills are becoming an urgent need and a condition for success for an increasing number of citizens of our country, they are needed to improve the efficiency of work, communication, access to information, and services. Large-scale use of ICTs leads to important social and economic effects: it changes the face of modern society, makes a significant contribution to economic growth and labor productivity, expands people's opportunities and improves their quality of life" [19]. For the first time in Russia, a large-scale study on assessing the level of digital literacy was conducted in 2017 by the NAFI Research center [20]. In this study, based on the results of the all-Russian population survey, the NAFI digital literacy index was determined, which is a comprehensive assessment of the current level of formation of digital economy competencies in the population and readiness for life in the conditions of digitalization.

Studies have shown that a higher level of digital literacy increases career prospects and expands job seekers opportunities, while the majority of the working-age population is aware of the importance of developing digital economy competencies for successful employment and effective work [21].

Thus, the importance of financial and digital literacy for the development of society and the state is indicated in a large number of publications; methodological issues of developing indicators of financial and digital literacy of the population are sufficiently developed; research is being conducted to such indicators quantify. At the same time, as found in the review of literature sources on the topic, the analysis of the impact of digital and financial literacy on the homogeneity of the economic space of the Russian Federation was not carried out, which makes this study relevant. This determined the purpose of this study.

An important task in this work is to select indicators for assessing the heterogeneity of the economic space in the context of the dependencies studied. Modern scientists suggest to use various indicators and criteria to assess the differentiation of socio-economic development of regions [22]. This paper focuses on human capital as the most important factor in the development of the economic space. Therefore, for this study, it seems reasonable to use indicators of socio-economic development of Russian regions that characterize the achievement of national development goals of the Russian Federation until 2030 to assess the heterogeneity of the economic space [23]:

- total average annual growth rate of the gross regional product, per capita;
- monetary income of the population, per capita;
- the level of employment of the population;
- increase (decrease) in financial assets (an indicator that reflects the increase (decrease) in deposits on the accounts of citizens, money in the hands of the population, expenses for the purchase of securities, foreign currency, changes in funds on the accounts of individual entrepreneurs, minus changes in loan arrears);
- the percentage of households have broadband Internet access;
- the percentage of organizations use broadband Internet access.

The peculiarity of the proposed system of indicators is that they all have the same focus. The higher indicator level means the better position of the region being evaluated.

The heterogeneity of the country's economic space is illustrated by the difference between the indicators of socio-economic development of regions.

It is advisable to analyze these indicators for the Federal districts of the Russian Federation, since at present it is in relation to these subjects of the country's economic space that the conceptual issues of the regional economy are formulated. Today in the Russian Federation there are 8 Federal districts: Central Federal District, North-Western Federal District, Volga Federal District, Ural Federal District, North Caucasian Federal District, Southern Federal District, Siberian Federal District, Far Eastern Federal District [24].

The following conditions and limitations had an impact on the choice of analysis methods for solving the tasks set in this work:

1. It was found, on the results of studying the available data on digital and financial literacy of Russians, structured by regions of the Russian Federation, that the number of sources of this information is limited. The reason is insufficient study of the impact of these competencies on inter-regional differences.

In fact, the only data on the digital and financial literacy of Russians provided in the research of the NAFI Analytical center are available for analysis [25-27]. Herewith, according to analytical reports on the financial literacy indicator of the Russian population for the federal districts, time series can be formed from only two values (for 2018 and for 2019); according to the digital literacy indicator, analysis by subjects of the Russian Federation was conducted only as of the beginning of 2020.

2. Consider estimates of digital and financial literacy have different units: financial literacy according to the method [27] estimated in points on a scale of 1 to 21, and digital literacy, calculated according to the methodology Digcomp [25], – in percentage points on a scale from 0 to 100. However, the common feature for both assessments is that regions can be ranked according to the calculated integral indicators, which allows them to be compared by their position in the rating table.

3. The essence of assessing the heterogeneity of the economic space is a multidimensional comparative analysis of individual indicators for the subjects of the Russian Federation. In order to achieve the ultimate goal of this study, the results of such an assessment for the Federal districts of the Russian Federation should be comparable with the estimates of digital and financial literacy of the population of the corresponding territorial units. This makes it necessary to calculate an integral indicator for each region, which will allow implementing a rating approach and, as a result, a joint analysis of all the indicators considered in this work.

Consider that in this study we should only to rank regions, but not to quantify the degree of their differences, the simplest method of rating construction in calculations and interpretation is chosen - the method used by the rating Agency "RIA Rating" [28].

To make a rating of the Russian Federation subjects by the level of socio-economic development, the method [28] is implemented in two stages: the first stage determines the rating score of the federal subject for each indicator, the second stage determines the integral rating score of the Federal district of the Russian Federation. In this case, the rating score of the subject of the Russian Federation for each

indicator is calculated in the range of values from 8 to 1. The rating score value is determined by processing the set of values of this indicator for all subjects of the Russian Federation so that the subject of the Russian Federation with the best indicator value gets a rating score equal to 8, and the subject of the Russian Federation with the worst value - 1. Integral rating of the federal district of the Russian Federation is defined as the geometric average of the rating points of all analyzed groups of factors. The maximum possible value of the integral rating of the federal district is 8, and the minimum possible is 1. The position in the rating table is determined in descending order of the integral rating value.

This rating, which is based on the aggregation of indicators of socio-economic situation, allows to answer the question about the position of a particular region on the economic map of Russia.

Data from the annual statistical reports of the State Committee of the Russian Federation on statistics used to be the sources that characterize the socio-economic indicators of Russian regions [29, 30]. In this case, statistics by region (in terms of indicators selected in this work to evaluate the heterogeneous economic space) is only available until 2018, inclusive.

4. Based on the combination of the above conditions for data selection, the correlation between digital and financial literacy of the population of the Russian Federation and indicators that characterize the heterogeneity of the country's economic space can be estimated based on data for 2018. However, the absence of dynamic series is not decisive for the interpretation of the results of this study.

5. This paper uses the assumption (justified by the current national dynamics) that the position of the Russian Federation's subjects in the rating table for the period 2018-2019 has not changed. This is to include in the calculations for 2018 available data on the level of digital literacy of residents of Russian regions.

6. The Spearman rank correlation coefficient should be applied for the purpose of statistical study of the relationship between integral indicators of financial literacy, digital literacy and the aggregate estimated indicator of heterogeneity of the economic space by their respective ranks in the subjects of the Russian Federation.

The calculations showed the following:

TABLE 1 RATING OF SUBJECTS OF THE RUSSIAN FEDERATION BY THE LEVEL OF DIGITAL LITERACY INDEX^{1,2}

| Position in the rating table | Central Federal District | North-West Federal District | Southern Federal District | North Caucasus Federal District | Volga Federal District | Ural Federal District | Siberian Federal District | Far East Federal District |
|---------------------------------|--------------------------|-----------------------------|---------------------------|---------------------------------|------------------------|-----------------------|---------------------------|---------------------------|
| By the digital literacy index | 3 | 1 | 7 | 8 | 6 | 5 | 2 | 4 |
| By the financial literacy index | 3 | 2 | 4 | 8 | 1 | 6 | 7 | 5 |

¹ Compiled by the author on the basis of research data [25, 26]

² The position in the rating table is determined by descending index values

TABLE II. RATING OF RUSSIAN REGIONS BY THE LEVEL OF SOCIO-ECONOMIC DEVELOPMENT IN 2018¹

| Russian Federation subject | Rating score of the subject according to the P _i indicator | | | | | | Integral rating | Position in the rating table |
|---------------------------------|---|----------------|----------------|----------------|----------------|----------------|-----------------|------------------------------|
| | P ₁ | P ₂ | P ₃ | P ₄ | P ₅ | P ₆ | | |
| Central Federal District | 3 | 8 | 8 | 1 | 6 | 7 | 4,48 | 3 |
| North-West Federal District | 7 | 7 | 7 | 3 | 8 | 8 | 6,35 | 1 |
| Southern Federal District | 4 | 4 | 2 | 2 | 5 | 5 | 3,42 | 6 |
| North Caucasus Federal District | 6 | 1 | 1 | 8 | 1 | 1 | 1,91 | 8 |
| Volga Federal District | 5 | 3 | 4 | 4 | 4 | 6 | 4,23 | 4 |
| Ural Federal District | 8 | 5 | 5 | 6 | 7 | 4 | 5,68 | 2 |
| Siberian Federal District | 1 | 2 | 3 | 5 | 2 | 3 | 2,38 | 7 |
| Far East Federal District | 2 | 6 | 6 | 7 | 3 | 2 | 3,90 | 5 |

¹ Compiled by the author on the basis of data [30]

Notation in the table:

P₁ - the compound annual growth rate (CAGR) of the gross regional product per capita, RUB (calculated by the author from the dynamic series of relevant statistical data for the period 2010-2017);

P₂ - per capita population monetary income (per month), RUB.

P₃ - the level of the population employment (as a percentage of the total population of the corresponding Russian Federation subject);

P₄ - increase in "+" (decrease in "-") financial assets (as a percentage of total cash income)

P₅ - the percentage of households that have broadband access to the Internet (as a percentage of the total number of households in the corresponding subject of the Russian Federation)

P₆-percentage of organizations that use broadband access to the Internet (as a percentage of the total number of organizations surveyed in the corresponding subject of the Russian Federation)

Results of the study of the relationship between digital and financial literacy of the population of the Russian Federation regions and indicators that characterize the heterogeneity of the country's economic space, performed by calculating the correlation coefficient the differences between the ranks of the Russian Federation subjects based on the above integral indicators are as follows.

The empirical value of Spearman's correlation coefficient between the indicators "region Rank in terms of socio-economic development" (SED) and "region Rank in terms of digital literacy" (DL) was $R_{SED\ DL}=0.524$, which indicates that there is a positive correlation with a noticeable relationship on the Cheddock scale.

Significance of the correlation coefficient ($T_{emp\ SED\ DL}$):

$$T_{emp\ SED\ DL} = R_{SED\ DL} \times \frac{\sqrt{n-2}}{\sqrt{1-R_{SEDDL}^2}} \quad (1)$$

$$T_{emp\ SED\ DL} = 0,524 \times \frac{\sqrt{8-2}}{\sqrt{1-0,524^2}} = 1,5070$$

The statistical significance of the calculated correlation coefficient, determined using the student's t-test, was $T_{tabl} = 2.4469$ (for the sample $n=8$ and for the significance level 0.05).

Thus, the $T_{emp\ SED\ DL} < T_{tabl}$, which does not allow us to reject the null hypothesis that the indicators are not correlated; the strength of the relationship between the SED and DL indicators is not significant.

The empirical value of Spearman's correlation coefficient between the indicators "region Rank in terms of socio-economic development" (SED) and "region Rank in terms of financial literacy" (FL) was $R_{SED\ FL}=0,643$, which indicates

that there is a positive correlation with a noticeable relationship on the Cheddock scale.

Significance of the correlation coefficient ($T_{emp\ SED\ FL}$):

$$T_{emp\ SED\ FL} = R_{SED\ FL} \times \frac{\sqrt{n-2}}{\sqrt{1-R_{SEDFL}^2}} \quad (2)$$

$$T_{emp\ SED\ FL} = 0,643 \times \frac{\sqrt{8-2}}{\sqrt{1-0,643^2}} = 3,1982$$

Thus, $T_{emp\ SED\ FL} > T_{tabl}$, which allows us to reject the null hypothesis that the indicators are not correlated; the strength of the relationship between the SED and FL indicators is significant.

Therefore, the statistical influence of the financial literacy level of the region's population on its socio-economic development is proved: the higher the level of such a component of human capital as financial literacy in the region, the less heterogeneity of the economic space in this region manifests itself. The obtained assessment confirms the assumptions based on the understanding of the logical relationship between the quality of a person's decision-making in the field of personal Finance on their financial well-being and the improvement of the region's economic indicators.

On the contrary, the existence of a significant relationship between the level of digital literacy and the socio-economic development of the region is not statistically confirmed. With a positive noticeable correlation coefficient indicating a direct relationship between these indicators, the result of calculating the statistical significance of the correlation coefficient

$R_{SED\ DL}$ suggests the opposite.

The following reasons can explain the resulting illogical conclusion, which contradicts the assumptions that have objectively developed in the modern economic space:

- possible unbalance or unrepresentativeness of the sample in terms of digital literacy;
- quality of statistical material;
- possible impact of the third "hidden" feature.

The task of identifying and quantifying the "third (hidden) feature" that affects the significance of the correlation between the level of digital competencies of human capital on the socio-economic indicators of the region is one of the directions of further research on this topic.

Another explanation of the identified dependencies seems reasonable also.

According to the results of NAFI research, the share of Russians with a sufficient level of digital literacy remained at a low level: in 2018, 26% of Russians had a high level of digital literacy, as of January 2020, this share was 27% [20, 25]. Therefore, the achieved level of knowledge and skills in the field of digital technologies may not be sufficient to ensure a significant impact on socio-economic processes in society.

All of the above confirms the relevance of currently implemented Federal projects that are part of the national program "Digital economy of the Russian Federation" [31], and allows us to formulate proposals for improving work in this area. It seems appropriate to introduce a meta-subject approach to digital literacy programs for the general population, which involves training in information analysis and data processing skills when studying the basics of digital literacy in relation to personal finance management issues.

IV. CONCLUSION

This study is based on the assumption that the potential of a person with a high level of digital and financial literacy, when used in the field of economic relations, can and should contribute to the effective interaction of the population with market infrastructure and financial institutions. Making informed decisions in the field of personal Finance, overcoming barriers between regions of the country due to the capabilities of ICT technologies will ensure the development of the economy and society and will effectively solve the problem of overcoming the heterogeneity of the economic space of the Russian Federation.

The hypothesis that using such a component of human capital as financial literacy, it is possible to overcome inter-regional differences caused by objective factors of uneven development of territories is statistically confirmed in the course of the study. This correlation should be taken into account for designing regional development programs. The existence of a significant relationship between the level of digital literacy and the socio-economic development of the region is not statistically confirmed. A possible economic justification for this fact may be that the current digital literacy level of the population is insufficient to ensure a significant impact on socio-economic processes, and that the influence of digital competencies of human capital on the socio-economic indicators of the region is offset by the influence of a "third hidden feature". It was also found that there is not enough representative high-quality statistical

material for the regions of the Russian Federation in terms of digital and financial literacy indicators. This problem should be addressed at the state level by defining appropriate reasonable assessment indicators and conducting regular monitoring using them. The solution of these problems determines the direction of further research.

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