UDC 338.49, 519.237

Anna Tikhonova
PhD (Economics), Associate Professor,
Department of Tax Policy and
Customs Tariff Regulation,
Financial University under the Government of
the Russian Federation;
Associate Professor of the Department of
Statistics and Econometrics,
Russian State Agrarian University -
Moscow Timiryazev Agricultural Academy
49 Leningradsky Ave.,
Moscow, 125993, Russian Federation
AVTihonova@fa.ru
ORCID ID:
https://orcid.org/0000-0001-8295-8113

Nadezhda Melnikova
PhD (Economics), Professor,
Department of Tax Policy and
Customs Tariff Regulation,
Financial University under the
Government of the Russian Federation
49 Leningradsky Ave.,
Moscow, 125993, Russian Federation
nmelnikova@fa.ru
ORCID ID:
https://orcid.org/0000-0001-7497-9176

Nadezhda Vishnevskaya
PhD (Economics), Associate Professor,
Department of Tax Policy and
Customs Tariff Regulation,
Financial University under the
Government of the Russian Federation
49 Leningradsky Ave.,
Moscow, 125993, Russian Federation
ngvishnevskaya@fa.ru
ORCID ID:
https://orcid.org/0000-0001-5403-8213

Readiness of Russian regions to digitize the economy

Abstract. The article examines the compliance of the technical and economic conditions of the Russian regions with the total digitalization process. As a research methodology, the authors used their own approach, based on carrying out an interval analytical grouping on a multidimensional average. 17 indicators were selected to calculate the multidimensional average. The indicators characterise technical and economic conditions for digitalization. Using the correlation analysis, the authors developed a mechanism to emit «noise» factors, i.e. factors which do not impact the general tendencies. The results of the analysis show the absence of a clear relationship between the level of socio-economic development and readiness for digitalization in the lower groups of regions. There is no clearly defined geographical dependence. Meanwhile, the City of Moscow and Moscow region are considered to be the leading regions. In the group with an average integral indicator, there appeared regions, which were the first to start switching to digital content. The main problem of digitalization is the lack of financial resources. In this connection, it is determined that the most effective way to finance digitalization is a public-private partnership.
Keywords: Digital Economy; Digitalization; Regions of the Russian Federation; Multidimensional Average; Interval Grouping; Correlation Analysis
JEL Classification: E69; C18; C100
Acknowledgements: *The article developed based on the results of research carried out at the expense of budget funds according to the government task for the Financial University in 2018.*
DOI: https://doi.org/10.21003/ea.V174-03

Тихонова А. В.
кандидат економічних наук, доцент, Департамент податкової політики і митно-тарифного регулювання,
Фінансовий університет, доцент кафедра статистики і економетрики,
РДАУ-МСГА ім. К. А. Тімірязєва, Москва, Російська Федерація
Мельникова Н. П.
кандидат економічних наук, доцент, професор,
Департамент податкової політики і митно-тарифного регулювання, Фінансовий університет, Москва Російська Федерація
Вишневська Н. Г.
кандидат економічних наук, доцент, Департамент податкової політики і митно-тарифного регулювання,
Фінансовий університет, Москва, Російська Федерація

Готовність регіонів Росії до цифровізації економіки

Анотація. У статті досліджуються питання відповідності техніко-економічних умов регіонів Росії до тотального процесу цифровізації. Для проведення дослідження автори статті використали власний підхід, в основу якого покладено метод інтервального аналітичного групування за середньою багатовимірною Для розрахунку середньої багатовимірної було відібрано 17 показників, що визначають наявність технічних і економічних умов для цифровізації. Шляхом використання кореляційного аналізу було розроблено механізм викиду «шумових» факторів. Результати проведеного аналізу свідчать про відсутність чіткої залежності між рівнем соціально-економічного розвитку й готовністю до цифровізації в нижчих групах регіонів. Не було виявлено й чітко-вираженої географічної залежності. У якості лідера тут можна виокремити м. Москва й Московську область. До групи із середнім інтегральним показником входять регіони, які одним із перших почали переходити на цифровий контент. На думку авторів дослідження, основною проблемою цифровізації є брак фінансових ресурсів. У зв'язку із цим було визначено, що найбільш ефективним способом цифровізації є державно-приватне партнерство.
Ключові слова: цифрова економіка; цифровізація; регіони Російської Федерації; середня багатовимірна; інтегральне групування; кореляційний аналіз.

Тихонова А. В.
кандидат экономических наук, доцент, Департамент налоговой политики и таможенно-тарифного регулирования, Финансовый университет; доцент, кафедра статистики и эконометрики, РГАУ-МСХА им. К.А. Тимирязева, Москва, Российская Федерация
Мельникова Н. П.
кандидат экономических наук, доцент, профессор, Департамент налоговой политики и таможенно-тарифного регулирования, Финансовый университет, Москва, Российская Федерация
Вишневская Н. Г.
кандидат экономических наук, доцент, Департамент налоговой политики и таможенно-тарифного регулирования, Финансовый университет, Москва, Российская Федерация

Готовность регионов России к цифровизации экономики

Аннотация. В статье исследуются вопросы соответствия технико-экономических условий регионов России тотальному процессу цифровизации. В качестве методологии исследования использован авторский подход, основанный на проведении интервальной аналитической группировки по многомерной средней. Для расчета многомерной средней отобраны 17 показателей, характеризующих наличие технических и экономических условий для цифровизации. С использованием корреляционного анализа разработан механизм выброса «шумовых» факторов. Результаты проведенного анализа говорят об отсутствии четкой зависимости между уровнем социально-экономического развития и готовностью к цифровизации в низших группах регионов. Нет четко выраженной и географической зависимости. Наиболее ярко выделяются в качестве лидеров г. Москва и Московская область. В группе со средним интегральным показателем присутствуют регионы, которые одними из первых начали переходить на цифровой контент. В качестве основной проблемы цифровизации отмечен недостаток финансовых ресурсов, в связи с чем определено, что наиболее эффективным способом финансирования цифровизации является государственно-частное партнерство.

Ключевые слова: цифровая экономика; цифровизация; регионы Российской Федерации; многомерная средняя; интервальная группировка; корреляционный анализ.

1. Introduction

Nowadays, full digitalization, automation and development of advanced IT technologies are an integral and inevitable process in any developed country. At the same time, it is difficult to predict the consequences of the spread of the digital space and to see a complete picture of the future, which means that the result of the forthcoming changes, in particular for the Russian Federation, is not predetermined.

Some active steps have been taken in view of transition to the digital economy format, which was also connected with the need to increase the investment and business attractiveness of Russia in 2016-2017. The investment portals of Russian regions, which represent a powerful channel of interaction with businesses, form an important tool. This tool was formed at the intersection of information and communication technologies and investment activity.

At the end of July 2017, Russian Prime Minister Dmitry Medvedev approved the Digital Economy Development Program in the Russian Federation known as «The Digital Economy of the Russian Federation». The program consists of five areas devoted to regulation, education, personnel, formation of research competencies, IT infrastructure and cybersecurity with a planning horizon up to 2024.

Unfortunately, the development of digitalization in Russia coincided with the global economic crisis, the imposition of sanctions and the difficult political situation in the world. This has aggravated the already difficult process of transforming a type 3 economy into Industry 4.0[1]. Given the significant differences in the level of socio-economic development of Russian regions, one can imagine how difficult it will be for the least wealthy of them to overcome the digital barriers of the economy. In this connection, the study is devoted to assessing the readiness of Russian subjects for total digitalization by using the authors' methodology based on the interval grouping of regions by the multidimensional average.

2. Brief Literature Review

2.1. Research in the field of digitalization of the Russian Federation

The Research Center «Economist Intelligence Unit», an analytical division of the *Economist*, published the results of study «The index of competitiveness of IT industry 2011» with the support of the International Business Software Alliance. According to the study, Russia ranked only 46th in the global IT competitiveness ranking with an index of 35.2 out of 100[2]. Significant problems in the development of the digital economy still exist despite the seven years that have passed since that time.

The main indicators of digitalization are:

1) high technology, including information and telecommunication (Gaslikova, Gokhberg, 2001) [1];
2) the development of digital advertising, which is the fastest growing part of the Internet economy with its annual increas by 50% (Garifova, 2014) [2];
3) strengthening of the role of information; leading organizations in every industry value the benefits of information, sometimes even higher than some traditional factors which impact revenue generating (Garifova, 2015) [3];
4) an increasing share of R&D in the field of digital technologies (Gruber, 2017) [4].

A significant number of modern studies are dedicated to the analysis of problems hindering the development of the digital economy in Russia. The studies by A. V. Babkin (Babkin, 2017) and D. M. Zozulya (Zozulya, 2018) are among them. Analyzing the peculiarities of the digital economy in Russia, A.V. Babkin notes that the quality of innovative development of domestic business entities does not meet the requirements imposed by digital space [5]. In this connection, the author sees the most effective lever for further digitalization of the Russian Federation in the development of IT innovations of business entities. D. M. Zozulya singles out the lack of awareness of business entities regarding the concept and technologies of Industry 4.0, as well as the backwardness of domestic IT technologies among the primary obstacles to digitalization [6]. The fact that domestic IT-companies do not occupy significant positions in the international IT-industry market indicates problems in the development of digital platforms (Biichuk, 2017) [7].

It is important to note that there has been no research in the field of comprehensive assessment of readiness for digitalization of all Russian subjects in both domestic and foreign literature. There are some articles devoted to the problems of involvement in the digital space of Russia's specific regions (Gerasimova, 2017; Bublik et al, 2018) [8-9]. Some studies are dedicated to the legislative regulation of the digitalization process in terms of the development of regional programs (Dvas, 2017) [10]. At the same time, the formation of a digital economy, in the first place, sets new challenges for regional innovation development, the main platform for which is the creation of an innovation infrastructure with information, institutional and research components (Apatova & Korolev, 2017) [11].

[1] Industry 4.0 represents a new stage in the development of manufacturing based on the integration of digital and physical systems.

[2] Reference: In 2009, Russia ranked 38th with an index of 36.2 by the same rating.

2.2. Scientific surveys in the field of methodology research

Several multidimensional indicators are widely used to assess different-quality phenomena in various fields of science. For example, analyses of the standard of living (through the dynamics of poverty) were conducted in the Brazilian municipalities in 2000 and 2010 (Costa, Machado & Amaral, 2018) [12]. The authors developed a multidimensional poverty index (MPI), which was subsequently calculated by decile groups of the population with regard to their income level. Earlier a similar approach to poverty assessment was considered in Dubois and Rousseau (2008) [13]. The use of multidimensional average is also proposed as an initial indicator of tax benefits efficiency in the early stages of its implementation. These data must be obtained over a period of time (Steshenko & Tikhonova, 2018) [14]. Quite often, multidimensional indices are applied in studies to identify the qualitative causes of economic transformation (Garbarino & Holland, 2009) [15]. Thus, a methodology of economic analysis similar to the author's one is presented in the work of A. G. Quaranta (Quaranta, Raffoni & Visani, 2018) [16].

Quite often, numerous indices are used in researches to identify the qualitative causes of economic change (Fotikova, 2016) [15]. A methodology of economic analysis, similar to the one proposed by the authors of this research, is presented in the work by A. G. Quaranta (Quaranta, Raffoni & Visanic, 2018) [16]. Scientists use multidimensional indices to assess the effectiveness of the banking industry (at 23 branches of an Italian bank). The study was carried out by stages. The developed procedure allows combining the strengths of the existing index approaches and includes a large number of performance indicators proposed in the literature (Step 1), reduction of multicollinearity factors (Step 2) and the subsequent classification of bank branches into efficiency classes through the clustering procedure (Step 3).

Some authors offer other options to calculate reduction of variables for multidimensional averages (Mingoti, 2005; Pasha, 2017) [17]. S. A. Mingoti uses the principal component analysis method PCA - principal component analysis or the Carhunen-Loeve transformation - to reduce the amount of analysed information (variables) and facilitate its use and interpretation. It should be noted that PCA makes it possible to provide a high degree of data informativeness with minimal distortion of their geometric structure (Gupta & Barbu, 2018) [18]. However, the use of this method makes sense only if the main component is significant (Galustyan, 2016) [19]. In addition, in condition of relative homogeneity of the information distribution, its use seems impractical because of the possibility to obtain similar results using simpler methods (Bulgakov, 2017) [20].

A. Pasha offers not to exclude factors when calculating multidimensional indicators, but to assign them a different value by establishing the appropriate coefficients using the example of MPI. In her study, she uses the multiple correlation analysis (MCA) to weigh indicators and explores its impact on estimates and relative poverty rates of 28 countries [21].

3. Research Methodology

We used general scientific research (analysis, synthesis, induction, deduction), econometrical and statistical methods. The author presents an integrated approach consisting in the staged application of correlation analysis and interval analytical grouping based on the calculation of the multidimensional average. This is a distinctive feature of this study in comparison to previously published surveys.

To conduct an objective and reliable assessment of the readiness for digitalization of the subjects of the Russian Federation, the first stage of the research is the selection of factors that characterize the current state of the «digital economy» at the regional level.

In this aspect, it is important to note that for the successful development of the digital platform, it is required to balance the three main elements, i.e. the producer, the consumer and communicative core ecosystems). Moreover, the state should be involved into them, to ensure tax, legal, financial and other orders and laws for successful control of the digitalization processes.

Therefore, total digitalization is possible only when all the three sides of economic relations (society, business and the state) are engaged in this process at the same level of involvement.

To conduct a comprehensive assessment, the following groups of indicators were selected:

1. Technical conditions for digitalization of legal entities.
2. Technical conditions for digitalization of individuals.
3. Technical conditions for digitalization state agencies.
4. The financial potential of the region for the digitalization of the economy (Figure 2).

The developed system of indicators makes it possible to determine the readiness of the national economy for digital development from three perspectives: business, consumers and government.

At the next stage of the study, it is necessary to exclude the so-called «noise» factors that artificially enhance the digital potential differentiation of the subjects of the Russian Federation.

The «noise» factors are indicators that closely correlate with each other ($R > 0.7$). To determine the «noise», it is recommended to use a matrix of paired correlation coefficients for all the 17 features. If there are several indicators that are strongly associated with a whole group of factors, it is reasonable to carry out the calculation of the correlation matrix in several iterations with the gradual removal of multicollinearity.

The remaining indicators should be checked for variability; the fact is that the use of statistical methods is possible only if the sample is homogeneous. In this connection, it is necessary to calculate the coefficient of variation for each factor and exclude those where the value is more than 33% (1):

$$V = \frac{\sigma_i}{\bar{x}_i} * 100\% , \quad (1)$$

where:

$\bar{x}_i$ - the average value of the indicator (in a whole for the Russian Federation);

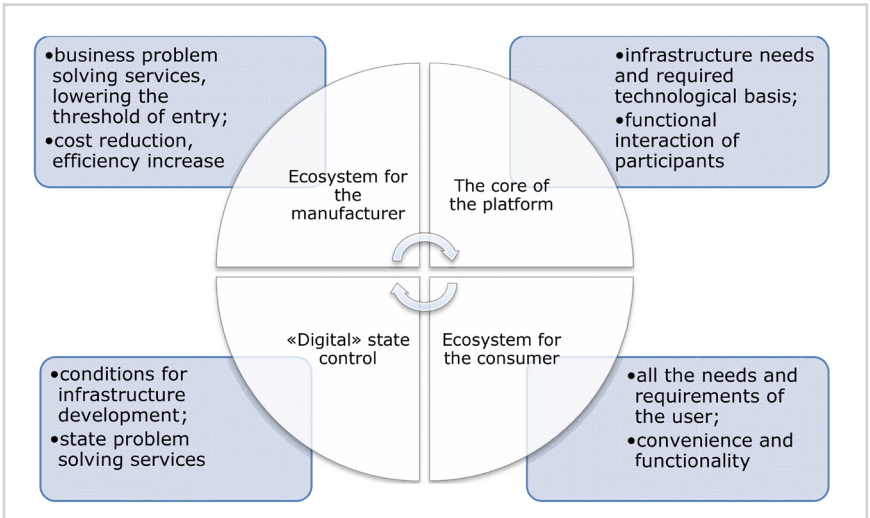

Fig. 1: **Digital economy architecture**
Source: Compiled by the authors

σ_i - the standard deviation for each of the indicators.

Based on the parameters that have passed the selection for multicollinearity and variability, the third stage of the analysis is carried out - grouping by the multidimensional average.

To group the subjects of the Russian Federation with differing characteristics, multidimensional comparative analysis methods are used. The methods are based on integral assessments and ratings determined quantitatively by using weights and are not subject to the subjective influence of an expert or respondent, as it is in a comparative analysis. Multidimensional arithmetic average is most optimal as such a technique, in which weighting factors are obtained by using the comparative characteristics of each indicator (x_i) with a maximum value (x_{max}) (2):

$$k = \frac{x_i}{x_{max}}. \quad (2)$$

In this case, the multidimensional average itself is defined as the arithmetic average coefficient for all indicators.

As a rule, a comparison with the average value is used to calculate the indicated coefficients. However, based on the stated goal of the analysis - the identification of potential digitalization possibilities - an orientation towards reference subjects for each criteria is necessary.

Conducting grouping on a multidimensional average implies the distribution of subjects of the Russian Federation into n groups according to their digital potential. The number of intervals (groups) with $N < 100$ can be calculated either as $\sqrt{N}$, or by using the Sturgess formula (3):

$$n = 1 + 3{,}322 lg_N. \quad (3)$$

With this sample size, the discrepancies obtained by the two formulas are insignificant. Then the interval step is calculated to determine the boundaries of the groups (4):

$$h = \frac{R}{n} = \frac{x_{max} - x_{min}}{n}, \quad (4)$$

where:

h - the interval step;

R - the range of variation;

x_{max} - the maximum value of the multidimensional average in the ranked row;

x_{min} - the minimum value of the multidimensional average in the ranked row.

The use of the proposed methodology is focused on a comprehensive assessment of the Russian Federation subject's potential in the field of digitalization with their relative qualitative homogeneity. The synergy of the statistical methods in use enables to receive the most reliable and objective results despite the flaws of each method separately.

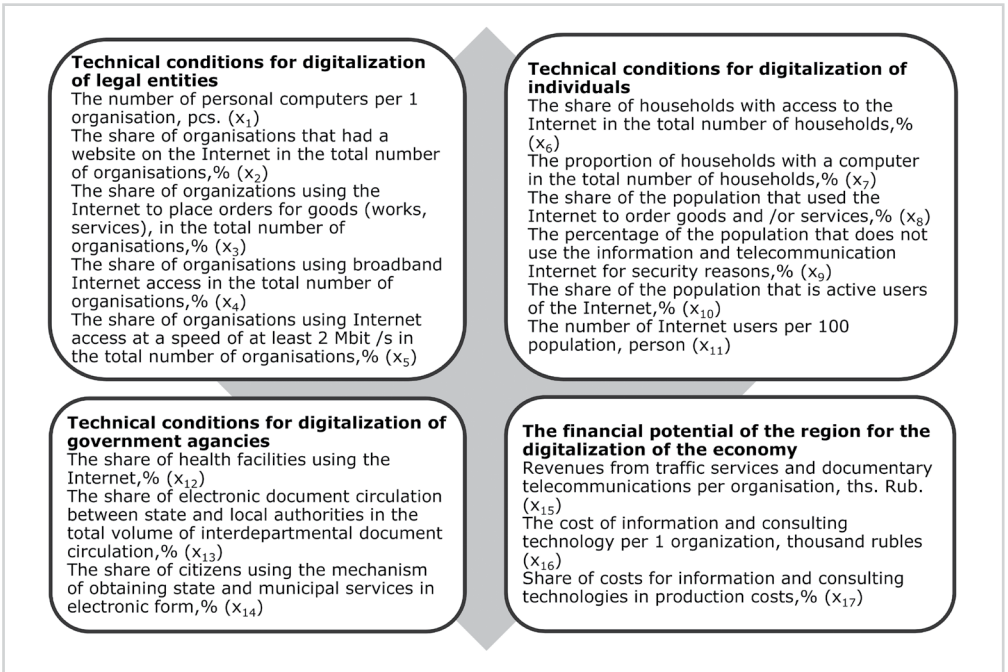

Fig. 2: **The system of digital potential indicators of subjects of the Russian Federation**
Source: Compiled by the authors

4. Results

The approbation of the authors' approach was carried out based on actual data for 2017 obtained through the Federal State Statistics Service of the Russian Federation. In accordance with the research methodology presented above, the authors made a selection of «noise» factors using the correlation tool of MC Excel.

By carrying out five iterations - a gradual exclusion from the calculation of the multidimensional average - 5 of 17 analysed indicators were emitted:

- the number of PCs per 1 organisation, pcs. (x_1);
- the share of organisations which use broadband Internet access in the total number of organisations, % (x_4);
- the share of households with a computer in the total number of households, % (x_7);
- the share of active Internet users in the whole population, % (x_{10});
- revenues from traffic services and documentary telecommunications per 1 organisation, thousand rubles (x_{15}).

The remaining 12 indicators do not have a close relationship with each other. Thus, it is possible to achieve the absence of multicollinearity (Table 1).

At the next stage of the study of the 12 analysed factors, we calculated the indicators of variation for the subsequent release of the overall variable parameters (Table 2).

According to certain coefficients of variation, factors x_9 (percentage of the population that does not use the Internet for information and telecommunication for security

Tab. 1: **The matrix of paired correlation coefficients of the indicators used to calculate the multidimensional average**

	x_2	x_3	x_5	x_6	x_8	x_9	x_{11}	x_{12}	x_{13}	x_{14}	x_{16}	x_{17}
x_2	1.00											
x_3	0.57	1.00										
x_5	0.52	0.45	1.00									
x_6	0.16	0.12	0.04	1.00								
x_8	0.15	0.43	0.21	0.39	1.00							
x_9	0.20	-0.15	-0.31	-0.03	-0.17	1.00						
x_{11}	-0.04	0.28	0.27	0.64	0.60	-0.41	1.00					
x_{12}	0.21	0.04	0.20	-0.20	-0.24	0.03	-0.26	1.00				
x_{13}	0.05	0.06	0.01	0.16	0.12	0.14	0.16	-0.09	1.00			
x_{14}	0.23	0.18	0.25	0.22	0.17	-0.09	0.17	0.16	-0.13	1.00		
x_{16}	0.25	0.29	0.36	0.21	0.18	0.00	0.22	0.02	0.07	0.02	1.00	
x_{17}	-0.19	-0.29	-0.21	0.11	-0.02	0.15	-0.01	-0.13	0.19	-0.28	0.05	1.00

Source: Compiled by the authors

Tab. 2: **Indicators of variation for the 12 factors under study**

Factor	Average value, see units at Fig. 1	Dispersion	Mean linear deviation	The coefficient of variation, %
x_2	47.4	64	8.0	17
x_3	41.2	42	6.5	16
x_5	58.4	111	10.5	18
x_6	76.3	38	6.2	8
x_8	29.1	89	9.4	32
x_9	0.6	0	0.6	99
x_{11}	76.0	32	5.7	7
x_{12}	96.0	19	4.3	4
x_{13}	51.8	509	22.6	44
x_{14}	64.3	159	12.6	20
x_{16}	320.5	354,689	595.6	186
x_{17}	2.02	0.5	0.7	33

Source: Compiled by the authors

reasons,%), x_{13} (the share of electronic document circulation between state and local authorities in the total volume of interdepartmental document circulation,%) and x_{16} (the cost of information and consulting technology per 1 organisation, thousand rubles) should be excluded from the calculation of the multidimensional average.

For the rest nine indicators, rationing to maximum was carried out for each of the factors of Russian subjects. Also, we carried out an interval analytical grouping, where:

$$n = 1 + 3{,}322lg_{85} = 9.2 \approx 9\ groups\,. \quad (5)$$

Further, the authors defined the interval step to find the boundaries of the groups (6):

$$h = \frac{0.95 - 0.59}{9} = 0.04\,. \quad (6)$$

The results of the analytical grouping are indicated in Table 3.

The results of the analysis show that there is no clear correlation between the level of socio-economic development of the region and its readiness for digitization in the majority of the Russian subjects. Also, there is no clearly defined geographical dependence. For example, the regions adjacent to the center (Moscow) fell into different groups: the lower (Ryazan and Tver regions), the middle (Tula, Kaluga and Yaroslavl regions) and higher (Ivanovo region).

Only the «richest» territories of the Russian Federation are clearly distinguished: the City of Moscow, Moscow region and the city of St. Petersburg are the absolute leaders in terms of digitalization.

Taking into account the fact that the maximum value of the multidimensional average of the proposed method can be 1, only 17 out of 85 subjects were able to score the final rating of more than 0.75, and none of them scored the optimal value of the integral index (1).

Then we determined a significant group of regions with an average regional value from 0.71 to 0.75, with 31 regions of the Russian Federation being included in this group. The group includes the administrative territories that began active work on digital platform development several years ago. For example, Vologda region is the very first region that signed an agreement on the elimination of digital inequality[3] in 2014. As a result, we can point out the setup of 157 Wi-Fi points in rural areas, as well as the creation of government agencies portal based on cloud technologies. Thorough work is being carried out in Kaliningrad region, where the next stage of the creation of the electronic document management is currently being completed. In addition, the region is actively attracting IT companies, creating tax and financial preferences in the territory of the Special Economic Zone.

The majority of Russia's regions cannot bear enormous financial expenses for the formation of a technological platform for the digitalization of the economy. Novgorod region is a bright example of this fact (the region is included in the second group (0.63-0.67). Back in 2017, the region developed amendments to the strategy of the socio-economic development of the region until 2030 in the field of digital economy which were never adopted due to insufficient funding.

5. Conclusions

Taking into account successful development of several Russian subjects, the multidimensional average reached

Tab. 3: **Analytical grouping of subjects of the Russian Federation by the multidimensional average**

№	The boundary of the multidimensional average	Number of subjects	Subjects
1	0.59-0.63	5	the Republic of Dagestan, the Republic of Mordovia, Kurgan Region, Chukotka Autonomous Region, Ulyanovsk Region
2	0.63-0.67	9	Kemerovo Region, Oryol Region, the Republic of Mari El, Samara Region, Tver Region, Ryazan Region, Novgorod Region, Magadan Region, Omsk Region
3	0.67-0.71	23	the Republic of Kabardino-Balkaria, Altai Territory, Kirov Region, Kostroma Region, the Republic of Chechnya, Tomsk Region, the Republic of Buryatia, Kursk Region, Volgograd Region, Penza Region, Udmurt Republic, Krasnoyarsk Territory, Karachay-Cherkess Republic, Perm Territory, Trans-Baikal Territory, Bryansk Region, Republic of Adygea, Arkhangelsk Region, Orenburg Region, Amur Region, Pskov Region, Saratov Region, Lipetsk Region
4	0.71-0.75	31	Kaliningrad Region, Irkutsk Region, Jewish Autonomous Region, Vologda Region, Voronezh Region, Sakha Republic (Yakutia), Stavropol Territory, Chelyabinsk Region, the Republic of Khakassia, Krasnodar Territory, Tyva Republic, Primorsky Territory, Tambov Region, Vladimir Region, Tyumen Region, Leningrad Region, Sverdlovsk Region, Nenets Autonomous District, the Republic of Komi, Chuvash Republic, Rostov Region, Smolensk Region, Tula Region, Khabarovsk Territory, the Republic of Bashkortostan, Kaluga Region, Yaroslavl Region, Republic of Karelia, Nizhny Novgorod Region, Astrakhan Region, Belgorod Region
5	0.75-0.79	10	the Republic of Ingushetia, Novosibirsk Region, the Republic of Kalmykia, Murmansk Region, the Republic of North Ossetia-Alania, Ivanovo Region, Kamchatka Territory, Sakhalin Region, Khanty-Mansi Autonomous Area - Yugra, the Republic of Tatarstan (Tatarstan)
6	0.83-0.87	3	Yamalo-Nenets Autonomous District, the City of St. Petersburg, the Republic of Altai
7	0.87-0.91	1	Moscow region
8	0.91-0.95	1	Moscow

Source: Compiled by the authors

[3] The project of the Federal Ministry of Communications and Rostelecom.

0.72 for the Russian Federation as a whole, indicating the absolute need for further development of the country's digital economy. The results obtained by the authors are generally correlated with the digital literacy index (DLI), which is regularly determined by the Regional Public Center for IT since 2015. According to the data of 2017, the DLI in Russia grew by 5.7%, making 6 points out of 10 possible.

It is important to note that regions are initially in different financial and technical conditions on their way to total digitalization. It is incorrect to compare the digitalization processes in relatively small regions of Central Russia, where even minimal access to the Internet will be tens (and sometimes hundreds) times cheaper than, for example, in Yakutia, where laying cable to the most distant locations is a multimillion project. In this connection, we believe that the best option for the development of digital platforms in the subjects of the Russian Federation is a public-private partnership. Currently, it is possible to ensure a significant degree of digitization of the national economy in a relatively short period only on the principles of co-financing.

References

1. Gaslikova, I. R., & Gokhberg, L. M. (2001). *Information technology in Russia.* Moscow: Center for Research and Science Statistics (in Russ.).
2. Garifova, L. F. (2014). The Economy of the Digital Epoch in Russia: Development Tendencies and Place in Business. *Procedia Economics and Finance, 15,* 1159-1164. doi: https://doi.org/10.1016/S2212-5671(14)00572-3
3. Garifova, L. F. (2015). Infonomics and the Value of Information in the Digital Economy. *Procedia Economics and Finance, 23,* 738-743. doi: https://doi.org/10.1016/S2212-5671(15)00423-2
4. Gruber, H. (2017). Innovation, skills and investment: a digital industrial policy for Europe. *Economia e Politica Industriale, 44*(3), 327-343. doi: https://doi.org/10.1007/s40812-017-0073-x
5. Babkin, A. V. (Ed.) (2017). *Digital transformation of the economy and industry: problems and prospects.* St. Petersburg: Publishing House of the Polytechnic University. Retrieved from http://inecprom.spbstu.ru/files/industry-2017/digital-transformation-economy-industry.pdf (in Russ.)
6. Zozulya, D. M. (2018). Digitalization of the Russian economy and industry 4.0: challenges and prospects. *Issues of innovative economy, 8*(1), 1-14. doi: https://doi.org/10.18334/vinec.8.1.38856 (in Russ.)
7. Biichuk, A. N. (2017). Digital transformation of business in the modern economy. *Economic environment, 2*(20), 14-16 (in Russ.).
8. Gerasimova, T. A. (2017). Digital economy of Russia and the potential of Irkutsk region. *Socio-cultural dynamics of Irkutsk region in the XX - early XXI century: materials of the All-Russian scientific-practical conference with international participation* (pp. 156-161) (in Russ.).
9. Bublik, N. D., Lukina, I. I., Chuvilin, D. V., Shafikov, T. A., & Yunusova, R. F. (2018). The development of the digital economy in the regions of Russia: problems and opportunities (on the example of the Republic of Bashkortostan). *Regional Economics and Management: electronic scientific journal, 53*(1), 5313. Retrieved from https://eee-region.ru/article/5313 (in Russ.)
10. Dvas, G. V. (2017). Formation of regional programs of digital economy development. *Management of economic systems: scientific electronic journal, 106*(12), 41. Retrieved from http://www.uecs.ru/uecs-106-1062017/item/4721-2017-12-19-10-41-38 (in Russ.)
11. Apatova, N. V., & Korolev, O. L. (2017). Problems of formation of the innovation infrastructure of the region in a digital economy. *Scientific Notes of the Crimean Federal University named after V. I. Vernadsky. Economics and Management, 69*((3)1), 3-11. Retrieved from http://sn-ecoman.cfuv.ru/wp-content/uploads/2018/02/001apatova.pdf (in Russ.)
12. Costa, G. O. T., Machado, A. F., & Amaral, P. V. (2018). Vulnerability to poverty in Brazilian municipalities in 2000 and 2010: A multidimensional approach. *EconomiA, 19*(1), 132-148. doi: https://doi.org/10.1016/j.econ.2017.11.001
13. Dubois, J.-L., & Rousseau, S. (2008). Reinforcing households' capabilities as a way to reduce vulnerability and prevent poverty in equitable terms. In F. Comim, M. Qizilbash & S. Alkire (Eds.), *The Capability Approach: Concepts, Measures and Applications* (pp. 421-436). Cambridge: Cambridge University Press. doi: https://doi.org/10.1017/CBO9780511492587.014
14. Steshenko, J. A., & Tikhonova, A. V. (2018). An integral approach to evaluating the effectiveness of tax incentives. *Journal of Tax Reform, 4*(2), 157-173. doi: https://doi.org/10.15826/jtr.2018.4.2.050
15. Garbarino, S., & Holland, J. (2009, March). *Quantitative and Qualitative Methods in Impact Evaluation and Measuring Results.* Issues Paper. Social Development Direct. Retrievd from http://www.gsdrc.org/docs/open/eirs4.pdf
16. Quaranta, A. G., Raffoni, A., & Visani, F. (2018). A multidimensional approach to measuring bank branch efficiency. *European Journal of Operational Research, 266*(2), 746-760. doi: https://doi.org/10.1016/j.ejor.2017.10.009
17. Mingoti, S. A. (2005). Análise de dados através de métodos de estatística multivariada: uma abordagem aplicada. *Belo Horizonte: Editora UFMG* (in Portug.).
18. Gupta, A., & Barbu, A. (2018). Parameterized principal component analysis. *Pattern Recognition, 78,* 215-227. doi: https://doi.org/10.1016/j.patcog.2018.01.018
19. Galustyan, M. Zh. (2016). Using the principal component method in selecting factors for forecasting the stock market in Russia. *News of Tula State University. Economic and Legal Sciences, 2-1,* 176-183.
20. Bulgakov, V. E. (2017). Iterative aggregation method for solving principal component analysis problems. *International Journal for Computational Civil and Structural Engineering, 13*(4), 47-52. doi: https://doi.org/10.22337/2587-9618-2017-13-4-47-52
21. Pasha, A. (2017). Regional Perspectives on the Multidimensional Poverty Index. *World Development, 94,* 268-285. doi: https://doi.org/10.1016/j.worlddev.2017.01.013

Received 10.10.2018