

## Human capital as a catalyst for digitalization of regional economy

Oleg Kichigin\* and Dmitriy Gonin

Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russian Federation

\*E-mail: sr201011@mail.ru

**Abstract.** The development of regional competitiveness is a challenge of our time. The elaboration of effective tools for this process offers opportunity to consolidate the existing and acquire new unique competitive advantages at both regional and national levels. The basis of any socio-economic development is a person whose effective performance reflects the level of his human capital. It can be argued that human capital, in the modern context, is becoming the basis for development of competitive advantages at all levels of competition. In this regard, assessment of competitiveness of the regional economy, which takes into account a human capital factor, is important for the analysis and creation of sustainable regional development processes. Improved technologies have offered economists new methods and tools for economic development. Digitalization of the economy is a prime example of this. The purpose of this work is to study human capital as a catalyst for digitalization of the regional economy. The subject of this study is substantiation of an assessing mechanism for regions' readiness to transition to the digital economy based on the factor of human capital analysis. The central subject of digitalization of the regional economy is the state. Therefore, when assessing regions' competitiveness and their readiness for digitalization, such factors as development of human capital in public administration of these regions were taken into account. The results of the study contribute to the development of the regional economic theory, the theory of human capital, and to the development of the efficiency assessment approaches of public administration in the framework of a limited resource base and ongoing challenges facing the state. As a result, it became possible to conduct a comprehensive assessment of the key social and economic regional institutions readiness for digitalization.

### Introduction

Fundamental changes in the socio-economic life of society at the turn of the 20th and 21st centuries led to an overdue and quite logical transition from the industrial type of organizing the social life of the population to the post-industrial or to, as it is also called, information type [1]. A broad conceptual and definitional framework was developed in the second half of the 20th century as a result: such concepts as 'post-industrial economy', 'innovative economy', 'information economy', 'knowledge economy', 'digital economy', and etc. were introduced in the scientific discourse. [2; 3; 4]. All these concepts are united by one global idea – information and knowledge, or human capital become the main means of production. 'Human capital is recognized as the main factor in the development of all spheres of public life, and improving the quality of human capital, producing new knowledge, developing high science-intensive technologies, and disseminating innovative development trends in various sectors of the economy become the key tasks of the new economy. A reassessment of the resource base, a change in the economy priorities are under way, the emphasis on physical capital shifts to intangible one, which is expressed mainly in human resources or capital [5]. Human capital in market economy is becoming a key resource that allows various business entities not only to occupy their market niche, but also to become an industry leader. Human capital currently has the largest share in the business value, serves as a development vector, as a safety margin, as a



'growth point' [1; 6; 7]. Knowledge and technology become indisputable competitive advantages. Human capital in the framework of the digital technologies development and digitalization of the economy, therefore, is considered not only as a competition policy instrument, but as a fundamental development basis as well. This determines the relevance of the study. The aim of the work is to study human capital as a catalyst for digitalization of the regional economy. The main objectives of the study are: 1. Studying the human capital assessment approaches. 2. Identification of the main criteria and indicators for assessing the regions competitive attractiveness, reflecting the level of development of human capital in a region. 3. Developing a rating of the region's focus on the digital economy growth.

A full-scale transition to the digital economy can only be achieved when all participants in the process reach the required level of development. Regions are such participants in the framework of the state. Thereby, the issue of their readiness to digitalize regional economy branches becomes relevant. In this regard, it is required to ensure the proper level of technology and all the necessary infrastructure development in each region. Human capital lies at the heart of digitalization as a set of knowledge-intensive technologies, and therefore, a different level of subjects' readiness to implement digital economy principles and its further growth is explained by the different level of human capital and areas related to it. Thus, the primary task is to assess the level of development of the human capital in each region.

### **Comparative analysis of the human capital assessment approaches**

To date, 'quite a lot of methodologies have been developed for assessing the status of human capital, both of an individual and of organizations in general, but a unified approach to assess this resource has not been developed. This is principally due to the specifics of the subject under study. In addition, there are, firstly, imperfection of measurement technologies, mathematical models, difficulties of statistical accounting; secondly, for a reliable assessment of human capital, it is necessary to take into account a number of dynamic factors, which are problematic to evaluate as a whole [8]. It should be noted that assessment of structural components of human capital takes place at different levels: micro-level – individual human capital and human capital of enterprises and companies; meso-level – human capital of major corporations and regions; macro-level – total human capital on a national economy scale; mega-level – united human capital on a global, worldwide scale' [1; 9].

Despite a variety of available evaluation methods, several basic approaches to assessing human capital are highlighted. The first is based on investments in the development of human capital (investment method), the subject of the second approach is capitalization of the return on investments made, the third approach allows evaluating human capital by natural indicators - skills, competencies, literacy levels, etc. Each approach is not without practical challenges, but, nevertheless, together they are the most versatile tool for assessing human capital [1].

The first approach, based on investment in human capital, includes three methods: assessment of the costs incurred; evaluation of the educational component; estimation of the monetary value of human capital.

The method of assessing human capital involves assessment with mandatory accounting of all kinds of costs that were aimed at maintaining human vital activities. Proponents of this assessment method suggest that the cost of producing human capital should be equated solely to those costs that can increase the productive abilities of people. Investing in education, for example. Despite the simplicity of calculations using this method, it allows calculating only a part of the accumulated human capital.

Another technique is focused on assessment of the educational component. Its author T. Schulz focuses on calculating the labor force capital as a whole, not just of the general population, and comparing it with the fixed production capital. Thus, the costs of the formation and development of human capital consist mainly of the direct public and private investment in education, and also include expenditures of students made to produce their qualifications [10]. The considered methods allow evaluating human capital at the macro-level, and therefore K.N.

Chigoryaev's approach to evaluation of human capital conducted at micro- and meso-scale seems interesting. The essence of this method is that all costs for formation of human capital are divided into three components: personnel's remuneration fund, costs of developing intellectual capital, and costs of maintaining and improving employee's health. Based on this provision, the formation of human capital becomes the prerogative of the employer, and the assessment result is the amount of the employer's investment in the personnel. Thus, the use of the considered approaches separately does not allow a thorough measurement of the amount of available human capital at any research level [1].

The second approach to assessing accumulated human capital involves accounting for monetary and non-monetary benefits. Accounting for the monetary returns on investments in the formation of human capital is not difficult: monetary benefits represent the sum of the employee's lifetime earnings [11]. It is quite problematic to assess non-monetary benefits associated with reducing the risk of unemployment, the prospect of career growth, and it is practically impossible to give a market assessment of the level of satisfaction with the work content and working conditions. The non-monetary type of returns can also include benefits that are not related to the sphere of market relations. Thereby, many studies prove a correlation between the level of health and the overall life expectancy and the number of years of the accumulated education. This relationship varies depending on a kind of work and economic conditions, socio-psychological resources, a person's lifestyle, and impacts of environmental factors [12].

The third approach to assessing human capital involves allowance for indicators characterizing the population from various points of view. In this method, a literacy rate of the population, an average number of years of education, a number of students in educational institutions at various levels, a number of researchers engaged in research and development, investments in the development of science and education, etc., that is, indicators that characterize the education system, professional training of employees, development of the scientific potential, are estimated. The advantage of this approach is the use of the obtained results in order to conduct interregional and intercountry comparisons of the accumulated human capital. Although, the estimates obtained are not able to cover the entire range of human knowledge. The key disadvantage of this technique is its complexity and a lack of tools for assessing qualitative characteristics of the population [1].

### Research algorithm

The considered methods clearly demonstrate the lack of universal approach to the assessment of human capital, but they allow obtaining the most possible objective result when combined.

The estimated human capital, in turn, enables considering economic entities in a different way: to identify development patterns of socio-economic processes, to identify their weaknesses, to develop a strategy for the regional development with allowance for the resources available. In addition, the assessment of human capital at a meso-scale level, in the context of regional differentiation, allows drawing a parallel between the population of the territory 'quality' and indicators characterizing effectiveness of the socio-economic policy followed in the region [1; 13]. We'll consider the regions readiness to digitalize their economies on the basis of a technique that enables assessing competitiveness of the business entities. The technique was developed by the members of the Institute of the Problems of the Regional Economy of the Russian Academy of Sciences research group [14]. The assessment of the competitive attractiveness of different regions in this model is based on the following criteria and indicators given in Table 1.

Table 1

### Criteria and indicators for assessing regions' competitiveness.

Evaluation criteria	Assessment indicators
---------------------	-----------------------

Economic	<ul style="list-style-type: none"> <li>- intensity and efficiency of the economic activity in the region;</li> <li>- progressive level of the economic structure from the point of view of Russia's strategic development;</li> <li>- capital stock equipment of the region's economy, its transport infrastructure and communications</li> </ul>
Innovating	<ul style="list-style-type: none"> <li>- new scientific knowledge production;</li> <li>- their application in new products, technologies, machinery</li> </ul>
Life quality	<ul style="list-style-type: none"> <li>- incomes and employment opportunities;</li> <li>- living conditions quality,</li> <li>- availability of medicine,</li> <li>- accessibility of cultural facilities, sports and tourism,</li> <li>- residential security;</li> <li>- presence of adverse effects of the vital activities on the environment</li> </ul>
Human potential	<ul style="list-style-type: none"> <li>- reproduction of the population;</li> <li>- professional qualification level of the population;</li> <li>- incidence rate;</li> <li>- spread of bad habits;</li> <li>- criminal rate.</li> </ul>

The position of a region in the competitive attractiveness ranking is, at its core, determined by an arithmetic mean of the obtained scores according to all criteria and represents an integrated assessment [15; 16; 17; 18]. The quantitative characteristics of the criteria used by us are regions' positions in the corresponding ranking. This methodological scientific material serves as the foundation for the comparative analysis of some of the regions' performances, and establishing their relationship with the position of a region in the regions' competitive attractiveness ranking. It should be noted that, when examined in detail, indicators on the basis of which the regional factor-ratings were calculated, contained structural components necessary for assessing human capital. Thus, the regions ranking of competitive attractiveness that we have at our disposal, can be recognized as identical to the regional ranking in terms of human capital development, which, in turn, allows us to identify the leading and lagging regions while implementing measures to digitalize the economy [1].

Two groups of regions (5 constituent entities of the Russian Federation) were identified for implementation of the current task and visualization of the results. The first group includes leading regions of the ranking, namely: Moscow, St. Petersburg, the Republic of Tatarstan, Moscow and Nizhny Novgorod Regions; the second group includes regions closing the rating: Orenburg Region, Jewish Autonomous Region, Kurgan Region, Altai and Tuva Republics. The decision to form the groups of this composition was made in order to prove or disprove the existence of patterns between the development level of human capital in the regions and the values of some key indicators of their socio-economic development. These indicators include: 1. gross regional product per capita; 2. volume of investment in fixed assets (excluding budgetary resources) per capita; 3. value of innovative activity of organizations; 4. proportion of highly skilled workers in the total number of skilled workers in the region; 5. A total number of unemployed and a tension rate on the labor market [1].

### Results

The above groups of regions, factor-ratings, and integrated assessment of the regions' competitive attractiveness, as well as a selection of indicators characterizing, in our opinion, the regions focus on developing the digital economy, are summarized in Table 2.

Table 2

Regions comparative analysis in terms of their competitive attractiveness

No.	Subject of the Russian Federation	RF subjects rates					Indicator name					
		Integrated assessment of the regions' competitiveness ranking	factor-rankings				Gross regional product per capita, thousand rubles	Investments in fixed assets (without budgetary funds) per capita, thousand rubles	Innovative activity of organizations, %	Proportion of highly skilled workers in the total number of skilled workers in the region, %	Total number of unemployed, as a percentage of economically active population (unemployment rate)	Labor market tension ratio, unit
			human potential	innovative potential	life quality	economic factor						
1	Moscow	1	6	4	1	1	1157,4	158,5	14,3	48,5	1,4	0,6
2	St. Petersburg	2	1	2	2	3	712,3	123,8	16,1	39,5	1,7	1,2
3	Republic of Tatarstan	3	10	6	3	7	499,7	163,9	22,2	31,6	3,5	2,0
4	Moscow Region	4	36	3	11	5	483,7	90,8	8,9	38,8	3,2	2,8
5	Nizhny Novgorod Region	5	26	1	6	27	363,3	75,3	11,1	29,0	4,2	2,5
6	Orenburg Region	79	57	81	61	59	387,5	91,6	6,4	28,1	4,6	5,3
7	Jewish Autonomous Region	80	63	83	81	51	283,7	64,1	6,7	19,2	8,3	0,9
8	Kurgan Region	81	60	71	79	71	225,9	26,3	4,6	26,3	9,1	5,6
9	Altai Republic	82	76	76	77	77	213,4	60,2	6,8	28,4	12,0	8,2
10	Tyva Republic	83	81	79	83	83	164,6	29,2	1,8	34,3	18,3	12,1

The source: [19].

Visualization of the data presented in the table demonstrates a huge gap in values of the absolute majority of indicators between groups of subjects allocated. The use of the statistical data, on the one hand, and the ranking of regions in terms of competitive attractiveness, on the other hand, is appropriate and provides reliable regional ranking not only in terms of socio-economic development, but also in terms of the prospects for digital transformation of their regional systems [20, 21].

Territories with the developed competitive advantages are more prepared for the transition to the digital economy and, in this regard, measures are needed to 'smooth out' the gap between the leading regions and the lagging ones. Obviously, smoothing should be carried out in the direction of leaders.

In order to prepare the regions for digitalization, we consider it necessary to introduce the mentoring practice in the format of inter-regional cooperation, when the leaders act as the mentors, and the lagging regions as the mentees. However, the exclusively methodological, information-analytical support should be provided, aimed, inter alia, at streamlining the organizational processes and improving the efficiency of public administration.

When it comes to effectiveness of public administration, it is important to emphasize that this is not about the size of the corresponding budget or availability of the special economic zones, but about the competency of the public authorities personnel – the human capital

accumulated in regional public administration sphere [22]. The lack of the suitable methods for assessing human capital in public administration, previously we proposed an approach to its assessment [23]. The result of the relevant assessment procedures is the human capital development index of the region's public administration.

Hence, when assessing the regions readiness for digitalization and development of the related areas, we consider it necessary to consolidate the assessment results of the regions' competitiveness and human capital development indices in public administration of these regions. As a result, it will be possible to conduct a comprehensive assessment of the key regional social and economic institutions readiness for digitalization.

A tool for smoothing out various degrees of regional preparedness for digitalization we see in the following algorithm:

1. Regions assessment according to the level of competitiveness of regional economies;
2. Assessment of the human capital development index in public administration of each region;
3. Identification of the leading and lagging regions by combination of the procedures results specified in paragraphs 1.2
4. Definition of the 'mentor - mentee' pairs of regions with approval of the corresponding program for development of lagging indicators.

The procedure for implementation of the measures presented can be approved by a decree of the Government of the Russian Federation in the framework of the execution of the Executive Order of the President of the Russian Federation, dated May 07, 2018, No. 204.

### Conclusion

The need to enhance efficiency of public administration, including its digitalization, is established by the Executive Order of the President of the Russian Federation No. 204 'On national goals and strategic objectives of the Russian Federation through to 2024' dated May 07, 2018 [24]. Pursuant to the Order, the national program 'Digital Economy of the Russian Federation' has been implemented since 2018, within the framework of which a number of federal projects have been developed: 'Normative regulation of the digital environment', 'Personnel for digital economy', 'Information infrastructure', 'Information security', 'Digital Technologies' and 'Digital Public Administration'. The federal project 'Digital Public Administration', for instance, is aimed at ensuring accelerated implementation of digital technologies in the economy and the social sphere through the use of digital technologies and platform solutions in the areas of public administration and provision of public services, as well as on qualitative improvement of some parameters reflecting the growth of the national economy and the social sector [25]; 'Staff for the digital economy' – another federal project [26], contains strategic basis of the professional training system for the digital economy. The analysis of these program documents leads to the conclusion that the dominant role in the regional and the national development does not belong to material resources (which, nevertheless, still remains significant), but to highly qualified personnel, capable of not only implementing large-scale projects, but also designing them, predicting trends in the medium and long term. It is the human capital that currently represents the most significant competitive advantage, both at a regional and national levels.

### References

- [1] Gonin D.V. 2016 Human Capital as the Instrument of Public Administration in the Sphere of Increasing the Competitiveness of the Regional Economy: Theoretical Aspects *Administrative Consulting* **96** (12) 108-117
- [2] Sukhareva M A 2018 From the theories of post-industrial society to the concept of knowledge economy and digital economy: a critical analysis of the terminology field *E-journal. Public Administration*, **68** 17-24

- [3] Skhvediani A E, Kudryavtseva T Y 2018 Socioeconomic development of Russia: Some historical aspects. *European Research Studies Journal* **7** 195-207
- [4] Niyazova S R, Kuporov J J, Nadezhina O S 2016 Development of an adaptive management model for innovative activities of an enterprise *Proceedings of the 28th International Business Information Management Association Conference, IBIMA 2016– Vision 2020* 2210-22
- [5] Balashova E S, Gromova E A 2017 Russian experience of integrating modern management models. *Espacios* **1** 20-27
- [6] Budanov I A 2017 Formation of an investment model of economic development of Russia *Studies on Russian Economic Development* **9** 147-53
- [7] Rodionov D G, Kudryavtseva T J, Skhvediani A E 2018 Human development and income inequality as factors of regional economic growth. *European Research Studies Journal*, 323-37
- [8] Rudskaya I, Rodionov D. 2017 Econometric modeling as a tool for evaluating the performance of regional innovation systems (with regions of the Russian federation as the example) *Academy of Strategic Management Journal* **16** 1-1
- [9] Pchelintseva I N 2008 Theoretical approaches to organizational-economic mechanism formation of the family human capital investment *Vestnik of Saratov State Technical University*, **1**
- [10] Kuporov Y Y, Avduevskaya E A, Bogacheva T V 2018 Investments in Human Capital: Efficiency of Investments in Higher Education in Russia. *Proceedings of the 31st International Business Information Management Association Conference, IBIMA 2018 – Vision 2020* 929 - 40
- [11] Shabunina T V, Shchelkina S P, Rodionov D G 2018 Regional habitat as a factor of the human capital assets development in Russian regions. *Journal of Social Sciences Research*, 313-17
- [12] Kiryanov D A, Sukhareva T N 2011 Assessment methods of human capital: Analysis and sufficiency of initial data. *Theory and Practice of Social Development*, **3**
- [13] Andreyeva D A, Kokushkina I V, Dvas G V, Malinin A M, Nadezhina O S 2018 Factors of Effective Regional Development and Labor Market Condition as Indicator of State of the Economy of the Region. *Proceedings of the 31st International Business Information Management Association Conference, IBIMA 2018 –Vision 2020* 5507 – 13
- [14] Grinchel B M, Nazarova E A 2014 Methods of assessing the competitive attraction Regions: monograph. *St.Petersburg State University of Aerospace Instrumentation (SUAI) Russia* 244
- [15] Dvas G V, Dubolazova Y A 2018 Development and Business Support of Innovative Enterprises in the Russian Federation *Proceedings of the 31st International Business Information Management Association Conference, IBIMA 2018 –Vision 2020* 5654 – 57
- [16] Rudskaia I 2017 A regional innovation system: Formation features and growth areas (case study: St. Petersburg) *Proceedings of the 30th International Business Information Management Association Conference, IBIMA 2017 – Vision 2020*, 541 –47
- [17] Rudskaia I 2017 Regional innovation foresights: drivers and barriers for development. *Proceedings of the 30th International Business Information Management Association Conference, IBIMA 2017 – Vision 2020*, 889-903
- [18] Rodionov D G, Rudskaia I A, Degtereva V A 2017 Assessment of the effectiveness of regional innovation systems in Russia *Proceedings of the 29th International Business Information Management Association Conference – Education Excellence and Innovation Management through Vision 2020* 3437-50
- [19] Regions of Russia. Socio-economic Indicators 2018 P32 Stat. Comp. / Rosstat – Moscow Russian Federation 1266
- [20] Bataev A V 2018 Analysis and Development the Digital Economy in the World. *Proceedings of the 31st International Business Information Management Association Conference, IBIMA 2018 - Vision 2020* 61 – 71
- [21] Demidenko D S, Malinin A M, Litvinenko A N 2017 A new classification of the risks of the quality processes *Proceedings of the 30th International Business Information Management Association Conference, IBIMA 2017 – Vision 2020*, 2892-97

- [22] Sharafanova E E, Fedosenko Y A, Skhvediani A E 2017 Regional Labor Market: Forecasting the Economic Effect of Cooperation between Universities and Entrepreneurs *Journal of Advanced Research in Law and Economics* **8(6)** 1908-15
- [23] Gonin D V 2017 Modern approach to assessing human capital in the public service // *Administrative Consulting* **101(5)**
- [24] Executive order of the President of the Russian Federation № 204 'On national goals and strategic objectives of the Russian Federation through to 2024' May 07 2018
- [25] Official website of the Ministry of Digital Development, Communications and Mass Media of the Russian Federation URL: <https://digital.gov.ru/ru/activity/directions/882/> (date of retrieval: Oct.07, 2019)
- [26] Official website of the Ministry of Digital Development, Communications and Mass Media of the Russian Federation URL: <https://digital.gov.ru/ru/activity/directions/866/> (date of retrieval: Oct.07, 2019)



Reproduced with permission of copyright owner. Further reproduction prohibited without permission.