

NETWORK HUMAN CAPITAL AS A FACTOR OF INTER-REGIONAL INTERACTION IN THE CONTEXT OF DIGITAL TRANSFORMATION: RUSSIAN AND FOREIGN EXPERIENCE

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ABSTRACT

Today, the process of digitalization is trying to affect all areas of human activity: people's consciousness is being transformed, as well as the ways of consuming information. In accordance with this, there is a need to transform the system of establishment and development of network human capital in the aspect of "smart" specialization, particularly for the needs of the digital economy. Activation of network human capital can be one of the factors of effective digital transformation of interregional cooperation. The main purpose of this study is to provide theoretical and methodological justification of approaches to the category "network human capital in the digital economy" as a factor of interregional cooperation. The first part describes approaches to the study of network human capital in Russian and foreign literature; the second part describes the main directions and methods of regulating investment in network human capital in Russia and other developed countries. In the final part, new scientific approaches to the study of network human capital as a factor of inter-regional interaction in the conditions of digital transformation and the mechanism of formation of network human capital taking into account the requirements of "smart" specialization are proposed. As the results of the study, we justify the theoretical and methodological approaches to the study of network human capital as an element of regional spatial development and as a "driver" of interregional cooperation considering the requirements of "smart" specialization. We also propose the project for the regional "smart" training center for the digital economy with the aim of improving the region's competitiveness on national and global labor market and of human capital transformation.

Keywords: *investment, network human capital, human resources, personnel development, digital transformation, digital skills, digital technologies, "smart" center, digital economy, interregional cooperation*

1. INTRODUCTION

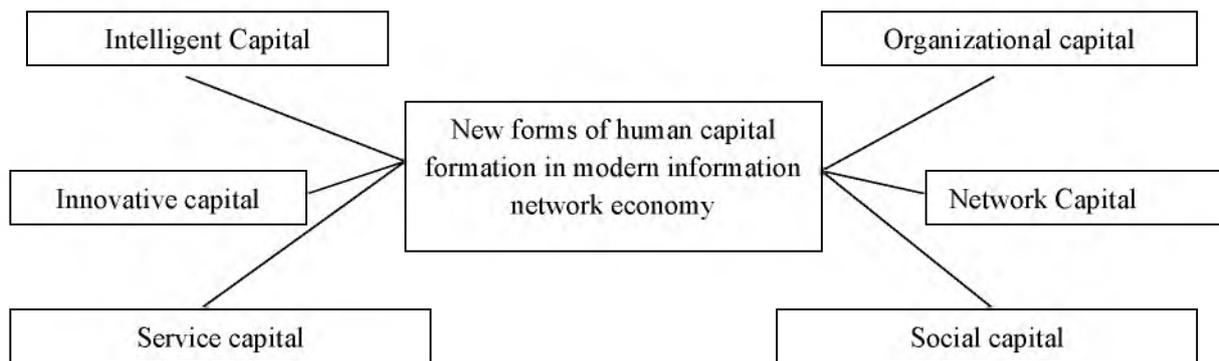
In modern market conditions the main direction of development of world economy is creation of new segments of information-network economy which are connected with digitalization and introduction of artificial intelligence systems on the basis of global neural networks. Based on this, the human capital of highly qualified workers becomes the most important network resource and a factor of high dynamism of the global digital economy and success in conditions of strengthening global innovation hypercompetitiveness. One of the first English-language works on the digital economy was D. Tapscott's 1996 (and reissued in 2015) book *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*. The author focused on the new opportunities for society to unite knowledge and creativity. He identified the main features of the new economy emerging from the active use of digital technology. Tapscott revealed the process of gradual transition to a new type of organization, and also noted the shortcomings of the digital economy, among which the growing inequality due to unequal access to technology. We also note the publication of B. Van Ark (2016), which points to the fact that the new digital economy has not yet led to a noticeable increase in productivity - it is, according to the author, still in the "installation phase", while productivity effects can only occur when the technology enters the "deployment phase". Among today's English-language works is a book by T. Scholz, published in 2017, titled "Uberworked and Underpaid: How Workers Are Disrupting the Digital Economy," which focuses on the problems of the workforce hired by digital economy giants such as Uber and Amazon. Some authors prefer to focus their works on specific technological solutions that accompany the transition of the economy to a new stage. This may be, for example, the case of blockchain technology (R. K. Nurmukhametov, P. D. Stepanov, T. R. Novikova, 2017) or the construction of the conceptual architecture of the digital industry ecosystem (Yu. M. Akatkin, O. E. Karpov, V. A. Konyavsky, E. D. Yasinovskaya, 2017). Works by Shuyun G., Din V., Lanshina T. (2017) and Smorodinskaya N. V., Katukova D. D. (2017) are devoted to international experience of digital economy management, as well as globalization - a process parallel to digitalization, directly related to the latter. Many authors analyzed the impact of human capital on the economic development of countries Hajiyeva L. A., Teymurova V.S. (2019), M. G. Gulaliyev, R. S. Muradov, L. A. Hajiyeva, H. R. Muradova, K. A. Aghayeva, E. S. Aliyev (2019). Finally, a considerable amount of research papers is devoted to the problems of personnel training in the digital economy, as well as to the characteristics of the labor market in the new era (for example, I.V. Kashinskaya, N.L. Korovkina, G.A. Levochkina (2018)). The impact of digitalization on the university education system is discussed, in particular, by N. V. Shashlo, G. V. Petruk (2017), V. S. Yefimov, A. A. Lapteva. B. (2018), E. V. Bolgova, G. N. Grodskaya (2019).

2. APPROACHES TO RESEARCH ON NETWORKED HUMAN CAPITAL

In the global information economy, traditional human capital is transformed into network human capital (or digital intellectual network capital). Compared to human capital in an industrial and market economy, human capital in a modern information network economy [12] acquires new properties and takes new forms (Figure 1).

Figure following on the next page

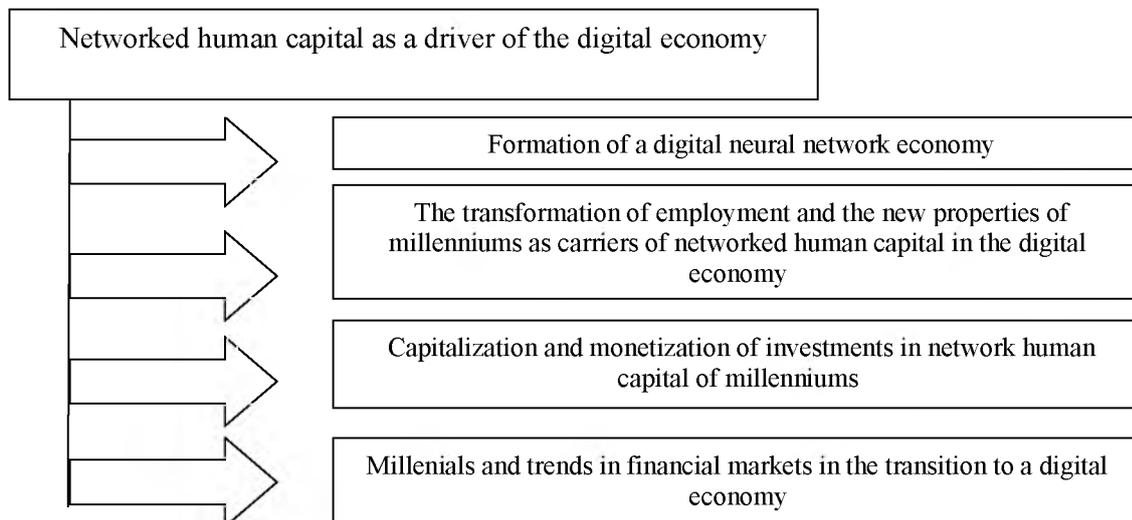
Figure 1: New forms of human capital in modern information network economy [9]



The activation of human network capital can act as one of the factors of effective digital transformation of the economy. In this regard, the issues of network human capital development and investing in it in the digital economy remain relevant. Digital transformation ensures the transition of the economy to a new stage of development. Digital technologies make fundamental changes in economic relations and in institutions of central-periphery inter-regional cooperation. Network human capital can be defined as a set of capitalized distributed network abilities, skills and competencies of managers, highly qualified workers and population. This set can be used for effective inter-regional interaction via the Internet:

- with networked government structures (e-government structures),
- with network business structures (e-business, innovative firms, offshore programming),
- networked scientific and educational communities (network research groups, digital libraries, network universities) and with social networks that are used to obtain various public goods, market benefits and network effects (Figure 2).

Figure 2: Directions for networked human capital as a driver of the digital economy



Today, in the context of the comprehensive development of the Internet and digital technologies, a variety of virtual social networks and online user communities are actively being created and functioning. Let us present these forms in more detail:

- crowdfunding - virtual associations of people to finance common projects, crowdfunding;
- crowd mapping - displaying information on the map by many users;

It should be noted that popular sites for crowdfunding in Russia are <http://planeta.ru/>, <http://boomstarter.ru/>. For example, the sites <https://www.experiment.com/>, www.PetriDish.org, www.iAMscientist.com raise funds for the implementation of initiative research. These resources make it possible to finance promising scientific projects, as well as to attract interest in science and promote the knowledge of advanced scientific research conducted in the world. These sites mainly finance projects related to ecology, biology, medicine and social sphere. Internet funding opportunities for social projects, including education, medicine, art, tourism, are expanding due to crowdfunding, which is an additional source of funding in human capital.

3. RUSSIAN AND FOREIGN EXPERIENCE IN RESEARCHING NETWORK HUMAN CAPITAL

Today, EU countries face a number of challenges in the area of human capital, ranging from a lack of qualified personnel for the knowledge economy to underinvestment in health care. In the 1970s, the hypothesis was advanced that the accumulation of individual benefits from education directly contributes to GDP growth; increases in per capita GDP and education levels go hand in hand. As the role of services in the economy grows (over 70% of GDP in OECD countries), so does the education level of workers. In the current version of the Europe 2020 Strategy, many points are somehow related to human capital (table 1).

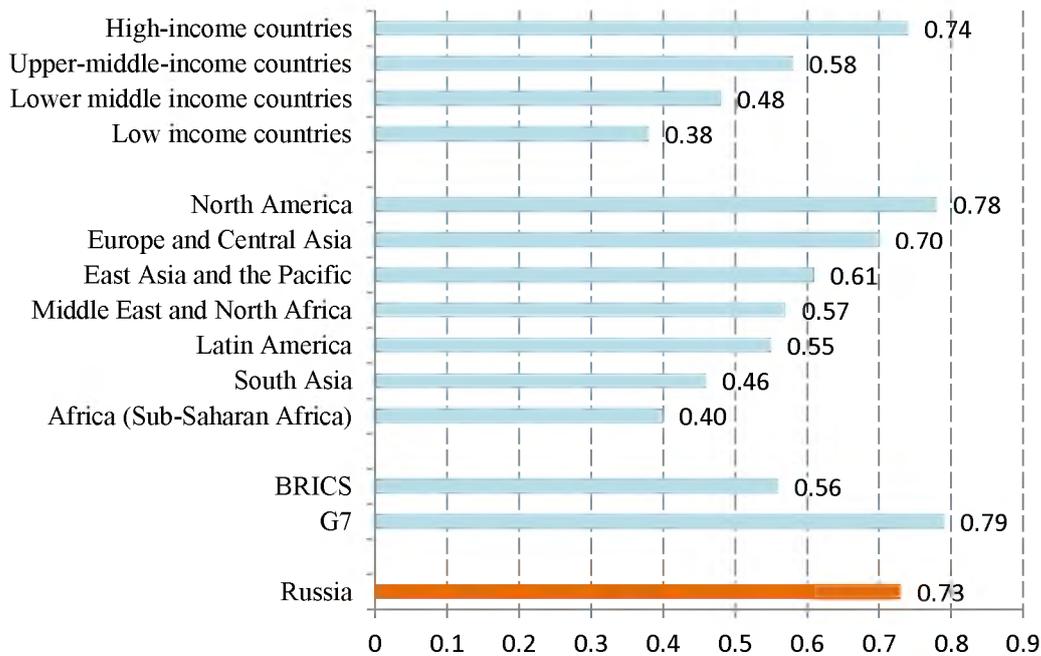
Table 1: Goals of the Europe 2020 Strategy related to the quality of human capital

Reasonable growth (based on knowledge and innovation)	Inclusive growth
Innovation: European Key Initiative an "innovation union" to improve framework conditions and access to R&D funding, innovation to strengthen innovation chains and accelerate investment in the EU	Employment and qualifications: European Key Initiative "An agenda for job and skills creation": modernizing the labour markets through greater labour mobility and skills development that contribute to successful employment
Education European Key Initiative "Youth on the move" to improve the functioning of education systems and increase the international attractiveness of European higher education	Education European Key Initiative "Youth on the move" to improve the functioning of education systems and increase the international attractiveness of European higher education

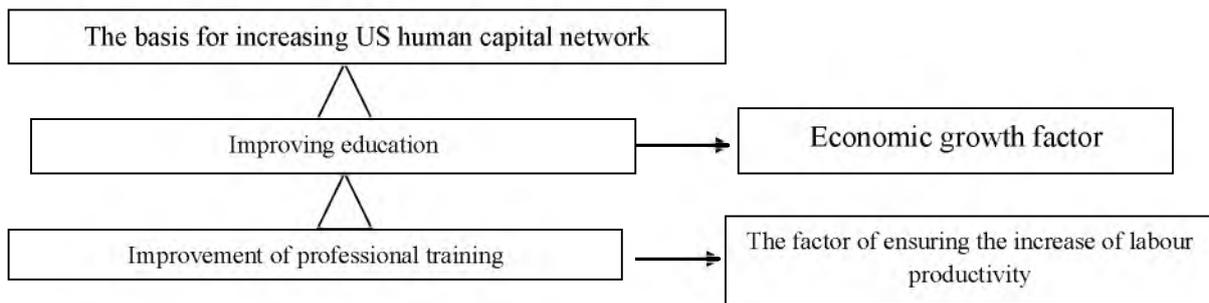
Global averages show that investing in education generates 5-15% additional income for each year of study (Hartog, 1999). For example, in Belgium, due to the availability of a diploma of tertiary education (as compared to a diploma of secondary education) the salary advantage reaches 30%, and in Hungary - even 117%. From a gender perspective, 25-64 years of age in Spain, Ireland, the Netherlands, the UK and Spain have more wage advantages for women than men (with a tertiary diploma). In other EU countries the trend is different (except Belgium, where gender opportunities are the same). Differences in income according to this principle with equal level of education remain significant and are partly explained by differences in choice of occupation, working hours, part-time employment. The cost of inaction in human capital development is increasing. Without human capital, countries will not be able to achieve sustainable economic growth, nor will they be able to create a pool of workers willing to take on future jobs that require advanced skills, nor will they be able to compete effectively on the global economic scene.

It should be noted that according to the value of the Human Capital Index calculated by the World Bank for 157 countries, Russia ranks 34th in the group of countries with high human capital. According to the World Bank estimates, the productivity of a person born in 2018 in the Russian Federation, upon reaching the age of majority, will amount to 73% of the potential level, which is possible with full education and full health. At the same time, the Russian Federation is slightly above the European and Central Asian region and is also well above the average for the upper-middle-income group (Figure 3). In addition, such institutions as the European Cluster Observatory and the European Cluster Policy Group are actively working to organize interaction between representatives of science, business and government, as well as to develop recommendations for the European Commission on issues of science, technology and industry policy, improving the legal framework, financial support for cooperation projects. In the UK, the National Training Task Force in cooperation with the British Confederation of Industrialists and the British Congress of Trade Unions has developed an international certification standard "Investors in People", which includes ten complex indicators aimed at improving the efficiency of the company through the development of network human capital of personnel [15].

Figure 3: Human Capital Index by Country Group, 2018.



Technoparks and business incubators are an important part of the infrastructural support for cluster development. They are designed to act as catalysts for the creation of innovation clusters through the competent use of human capital networks. Examples can be given of the use of human capital networks in the development of US-Mexican cluster systems in light industry, as well as US-Canadian aerospace clusters. Negotiations are currently under way to develop cross-border intercompany networks within the framework of the Transatlantic Partnership, an emerging integration alliance. At the same time, the higher level of international cooperation of the EU member states shows that the European countries, which maintain a technological gap with the United States, are directing their efforts towards the creation of joint cluster systems to enhance the global competitiveness of their producers. The issue of immigration, especially of relatively highly qualified personnel, becomes particularly relevant for the US economy in the area of human capital (Figure 4).

Figure 4: Basis for increasing network human capital in the USA

Within the framework of the Russian program "Digital Economy" it is planned to form a neural network education system, which will train personnel with network competences and rely on the neurocognitive mechanisms of acquisition of new knowledge, the use of neurocomputer interfaces, elements of virtual and augmented reality, hybrid intelligence [8]. Currently, products and services of the neural network education market are being developed in such segments as distance learning, lifelong learning, mass open online courses, blended learning, innovative models of additional education, and by 2035 - the full use of integrated systems of natural and artificial intelligence [13]. In the digital economy, various networked institutional management structures, including public authorities at the global, federal, regional and local levels, are being formed as part of inter-regional cooperation. The leading place in the structure of institutions of management and regulation of the globalizing digital economy is occupied by electronic network institutions of management, regulation and control, the most important of which is the e-government (e-government), which can be considered as an institutional and organizational form of manifestation and implementation of network management human capital. Today such new forms of education as distance and network education are actively developing. Network universities are being created, which operate on an integrated system (unified Internet platform) of providing distance education services via the Internet and whose participants are the leading universities in Russia and other countries. For example, at Lomonosov Moscow State University, member universities of the Eurasian Association of Universities have adopted and signed a memorandum of understanding on the establishment of a Eurasian Network University (ESU). The objectives of the EEU are to develop the human and intellectual capital of the Eurasian Economic Union, to promote global competitiveness and long-term prosperity of the economies of the EAEC countries. As a whole, Internet technologies, electronic network means of communication allow to pass to a new stage of formation of network human capital and network infrastructure of its effective use, and also development of the distributed cooperation and integration of universities in organizational, educational, methodical and research areas of various regions of Russia, the countries of near and far abroad.

4. MECHANISM OF NETWORK HUMAN CAPITAL CREATION

Russia's regions are diverse in the quality of human capital, quality of institutions, level of creativity, tolerance and innovation, i.e. ability to quickly master new technologies. For example, the Ural macro-region objectively has prerequisites for transition to a new industrialization path, for transformation into another economy without acute crises and shocks. The need for new industrialisation for the Ural is connected, firstly, with ensuring the restoration of traditional basic industries on a new technological basis (a policy of reindustrialisation), and secondly, with the creation of new industries of the fifth and sixth technological stages, which would make it possible to raise not only the region's economy but also the entire country to a new level of development. The creation of networks means a fundamentally new stage in the development of higher education both in regions and in macro-

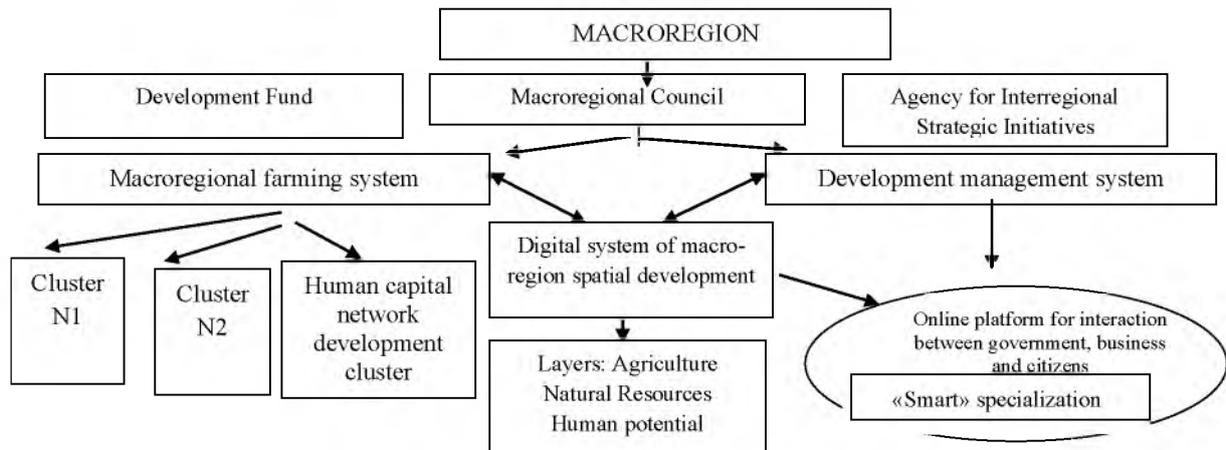
regions. One of the brightest examples of successful scientific partnership is the network scientific and educational laboratory "Dynamic Modeling and Control of Responsible Structures" of Tomsk Polytechnic University and its network partners - Tomsk State University, The Technical University of Berlin, Institute of Strength Physics and Material Science of Siberian Branch of Russian Academy of Sciences and JSC "Rocket and Space Corporation "Energy" named after S.P. Korolev. The basis of this network structure is the interaction of human capital of universities, teams of scientific and research and production organizations of the Ural macro-region. It should be noted that in the corporations of the Ural macro-region the economic effect is achieved through real interaction between three institutional sectors - the state, production, and science (education). In foreign economic literature, this triad is identified as the "triple helix" model. The leading role in this triad is played by universities, not the state. The logic of this model based on universities is simple: only the efforts of young people can build a new innovative economy. This is why the Ural State University of Economics, being a university that is integrated into the regional economy and produces in-demand specialists, sees the study of new industrialisation as a priority area of its scientific work. In 2007, six state corporations were established in Russia, including Russian Technologies, Rosatom, and RUSNANO (currently RUSNANO). The Ural macro-region has managed to preserve its "genetic code" - an industrial model with a core of production facilities combined with the necessary intellectual resources and human capital. The decisive factor that initiates progressive structural shifts in the economy of the Ural macro-region is the launch of new industrialization processes based on priority support for competitive technologies in the most important strategic areas [15]. Personnel problems include, firstly, ageing of personnel in higher engineering and technical education. The capabilities and resources of specialists educated during the Soviet era are often insufficient to work with new technologies. Second, among the personnel problems in the engineering industry we can single out the "brain drain". No matter how skeptical may we be about this phenomenon in recent years, the fact remains: highly professional specialists with significant intellectual potential, if not go abroad, then move to the central regions of Russia, where a significant number of knowledge-intensive enterprises are concentrated. Financial problems include, first of all, outdated material and technical base, lack of modern equipment in higher education institutions. This is due to the low level of financing of most modern Russian universities in general and the Ural Federal District in particular. Let us consider the Far Eastern macro-region, the leader of the Russian shipbuilding industry. The Far Eastern Shipbuilding and Shiprepair Center, Amur Shipyard in Komsomolsk-on-Amur are growth points of the shipbuilding industry, activation of which is a strategically important task fixed in the state program of shipbuilding development till 2030. An important problem for the development of the regional economy in the conditions of digital transformation is weak interest of the management in the introduction of scientific and technological achievements into production and, as a result, weak inclusion of many innovative companies into the international exchange and cooperation. Significant qualitative features of the formation of network human capital associated with the formation of entrepreneurial activity, including the objective need for a close link between education and production activities, are due to the digitalization of the economy. Optimization of organizational linkages allows the effective use and growth of human capital, which is directly related to the innovation activity of enterprises in the region. The Zvezda shipyard of the shipbuilding cluster on the basis of the Far Eastern Shipbuilding and Ship Repair Center is an example of a large-scale innovation process in the industry area. In modern market economy conditions, management of innovative development of shipbuilding and ship repair is possible only within the framework of the cluster approach. The level of development of the network human capital is to a great extent at critical levels. At present, the pace of innovation development of the Far Eastern macro-region is still insufficient. An essential problem is insufficient provision of the implemented and planned projects with

qualified personnel. This is why the sphere of education, science and manufacturing in the Far East should be given priority attention. Development and implementation of new methodological approaches to solving the problem of optimization of human capital management will make it possible to form prerequisites for qualitative and stable growth of the Far East economy. Let us separately consider the South Growth Pole, the Krasnodar Region, which is a leader in human capital accumulation as a key asset and the basis for long-term competitiveness. The centre of the South Growth Pole, territory of high quality of life, possessing steady system of settling within the limits of "clever" cities and the villages created for the people keeping and developing multicultural traditions and the nature of Kuban and Black Sea coast. The main form of interaction between regions is interregional clusters, which allows for the implementation of major joint projects, while attracting the attention of world-class investors. From the point of view of using the existing potential, inter-regional clusters are relevant and expedient to form and develop in the following areas and activities: 1) production and processing of agricultural products; 2) tourist and medical services; 3) social services to meet the needs of the local population and development of human capital [15]. The main directions for improving the efficiency of the use of human capital network in the South Growth Pole are the following:

- development of a forecast of the agricultural sector's personnel competencies for the long-term period (including a prospective list of key competencies and qualifications);
- preparation of an action plan to take into account the provisions of the forecast of agro-industrial complex personnel competencies in professional and federal state educational standards and programs of additional professional education;
- development of human resources potential capable of introducing and mastering innovations based on stimulating employment at agricultural enterprises, increasing the attractiveness of labor in agricultural production, finding effective forms of agricultural education development and its integration with science;
- development of training systems for specialists in the agricultural sector at various levels of education, including primary education;
- creation of a system of training, retraining and professional development of personnel, including in the field of modern crop and livestock production technologies to ensure sustainable development of the complex;
- to meet the needs of food and processing industry enterprises for qualified personnel, including in the application of innovative technologies and technologies of deep processing of products;
- encouragement of attraction of qualified personnel;
- carrying out organizational and socio-psychological work aimed at increasing the efficiency and thrift of machinery and resources in the agro-industrial complex;
- conducting review seminars on the possibilities of introducing information technologies into the production process involving independent experts and software developers on a permanent basis [17].

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Figure 5: Model of macro-region management by formation of network human capital in conditions of digital transformation [1]



In our opinion, the modern regional economic system as a result of digital transformation should be based on "smart" specialization in the framework of interregional cooperation, as we face the problem of lack of educational platforms that would ensure the market saturation with such specialists. Within the limits of the decision of the given problem the model of management of macroregion at the expense of formation of the network human capital in the conditions of digital transformation is offered (figure 5). Based on the model presented, it should be noted that "smart specialization" is aimed at using the links that arise between the areas of economic activity and the traditional boundaries of clusters. Clusters are elements of the region's innovation ecosystem, while smart specialisation is a much broader policy aimed at transforming the system itself. Nevertheless, clusters can be brought closer to 'smart specialisation' if they stimulate new areas of knowledge diffusion with a high degree of impact on economic growth.

5. CONCLUSION

In general, the activation of human network capital can act as one of the factors of effective digital transformation of the economy. Digital transformation ensures transition of economy to a new stage of development. The effective way of activation of formation and development of macro-region are inter-regional clusters which for today from positions of world and domestic experience represent one of the most effective kinds of the spatial organization of economic activity in territory. Clusters allow to concentrate the network human capital of enterprises and organizations of various industries, taking into account the requirements of "smart specialization" in the digital transformation.

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