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SCIENCE AND EDUCATION AS THE CENTRAL FACTORS IN THE TRANSFORMATION OF HUMAN CAPITAL

LA CIENCIA Y LA EDUCACIÓN COMO FACTORES CENTRALES EN LA TRANSFORMACIÓN DEL CAPITAL HUMANO

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ABSTRACT

The article explores the significance of education and science as central factors in the accumulation and formation of human capital in the process of technological and socio-economic development. The authors analyze the educational and scientific aspects of social progress responsible for the quality and development of human capital. The study investigates the prospects of social development with regard to the implementation of current scientific discoveries and educational technologies. The paper also analyzes technologies designed to improve the physical, mental, intellectual, and moral characteristics of people, as well as ways to overcome emerging crises. Radical differences among the models of the future inherent in socio-political thought in China and the USA are revealed.

Keywords:

Human capital, knowledge society, social score, technological progress, education.

RESUMEN

El artículo explora la importancia de la educación y la ciencia como factores centrales en la acumulación y formación de capital humano en el proceso de desarrollo tecnológico y socioeconómico. Los autores analizan los aspectos educativos y científicos del progreso social responsables de la calidad y el desarrollo del capital humano. El estudio investiga las perspectivas de desarrollo social con respecto a la implementación de los descubrimientos científicos y las tecnologías educativas actuales. El documento también analiza tecnologías diseñadas para mejorar las características físicas, mentales, intelectuales y morales de las personas, así como formas de superar las crisis emergentes. Se revelan diferencias radicales entre los modelos de futuro inherentes al pensamiento sociopolítico en China y los Estados Unidos.

Palabras clave:

Capital humano, sociedad del conocimiento, puntaje social, progreso tecnológico, educación

INTRODUCTION

The notion of human capital denotes the skills and knowledge obtained by individuals through education, professional training, and accumulation of experience that are capable of generating income for their bearer. Human capital is created by each individual person and consists of the sum of their intellectual capabilities and acquired skills.

Human capital is the main driving force of society, which deserves particular attention. In the 20th century, the newly developed theory of human capital considered two capitals – physical capital and human capital. This theory argues that the maintenance and improvement of quality characteristics in education and health care generate long-term economic resources. For example, high-quality healthcare increases the time an individual can use their accumulated knowledge. People with a college degree are more likely to find high-paying jobs in better conditions as compared to people with a high school education. This inspires the conclusion that tangible goods facilitate the improvement of intangible goods (Vartanova & Gladkova, 2020).

In the future society, science will be the main productive force. The potential of each society will be measured by the scale of the information and knowledge it possesses. Science and education are major factors in the reorganization of society. The future society is generated by the successes of education, developed through the successes of science, and really governed by the social stratum that makes these successes possible. Such a society is characterized by rapid social change and, as a consequence, by rapidly changing norms of behavior.

All new discoveries will eventually become human-centered, with the technologies that change the natural environment and create new artificial habitats increasingly receding into the background. With technological singularity coming nearer, a greater emphasis is placed on promising scientific and technical developments bringing change to human beings themselves. The effect of these developments is now clearly apparent in the form of increasing information flows and the introduction of virtual reality technologies. These technologies are, in one way or another, relevant to education.

The challenges facing today's society require a new quality of education for future generations. The demands of society and its striving for a scientific-technological breakthrough set the task of researching new, more costly, and advanced teaching methods. Digitalization of the education system is also inevitable.

Today, in an environment of change and high uncertainty, the ability of a company's employees to learn more productively and faster than others can become the basis of its competitive advantage, and this is what the world's leading organizations are focusing on by funding education.

The contemporary economy sells and purchases human skills, and creative abilities are sold alongside other components. Human capital also has a "double" value, because when it is consumed, it also develops. That is why the efficiency of investments only grows with time, not diminishes. Researchers are deeply interested in the effects of educational technologies on the quality of human capital (Webb, et al., 2018; Petrova & Fokina, 2021) as well as in studying the role of human capital in entrepreneurial activity (Che & Zhang, 2018; Piontek & Piontek, 2019), in science and technology (Amandykova et al., 2016), and other spheres.

In the age of rapid development of society, an important component in the multiplication of human capital is digital technology. At present, the Russian education system faces a difficult choice: either to return to the rigid administrative-command measures, well-proven in the past or to introduce a different, more advanced digital approach in the implementation of the educational process.

The term "human capital" was first coined by Theodore Schultz. He also developed and popularized one of the branches of the concept of human capital – the idea of educational capital. Schultz asserts that all people initially possess an individual set of genes responsible for skills and abilities, along with the talents that the person will eventually wish to develop, which ultimately combine into a single whole and constitute the person's capital (Gvozdeva & Kazakova, 2017).

In many works, the role of science and its capacity to solve social problems is absolutized (Masuda, 1981; Galbraith, 2004; Bell, 2004). According to Bell (2004), the foundation of post-industrial society should be sought in the unprecedented influence of science on production. The scientific community was born under capitalism, but it did not gain its full development and influence there. Science, as a quasi-autonomous force, will continue to evolve. Bell (2004), identifies two major features of post-industrial society: the central role of theoretical knowledge and the expansion of the service sector relative to the producing economy. Post-industrial society loses its pronounced class structure, property ceases to be the basis of social structure, and the capitalist class is replaced by a ruling elite with a high level of knowledge and education.

In its essence, knowledge is a collective good. Post-industrial society has a different infrastructure, created

by digital information technology, which will connect the world at a whole different level from the industrial era. A future-oriented worldview erases the traditional values and moral foundations of society.

One of the concepts of information society was outlined in Masuda's book "The Information Society as Post-Industrial Society" (1981). The information society, according to his theory, should emerge as a result of the information revolution.

The information revolution should swiftly transform into a new productive force and, as a consequence, mass production of systematized information and knowledge will follow. In this, the frontier of the knowable will be a potential market. This is a society in which the majority of workers are engaged in information work or knowledge production. Information is seen by Masuda (1981), both as a social good and as an economic category, transforming all spheres of life in a progressive direction.

The Japanese scholar asserts that all aspects of a person's development, be it professional growth, education, political and economic activity, or various types of leisure activities, will take place in the information sphere. The basis of the information society will be information and computer technology with its fundamental function of replacing or enhancing the intellectual activity of man himself. Interestingly, what becomes the greatest value in this society is time, which drastically distinguishes it from post-industrial society, in which consumer demand is the most valuable. Masuda's ideas are coming to life all over the world, as now more than 50% of the world's workforce is already working in the field of information activities.

Analyzing the theoretical background of the term "information society," we should also especially note John Galbraith's "The New Industrial Society" (2004), since a large number of later conceptions of a post-industrial society based on the development of science, knowledge, and high technology are related to this very book.

Of particular significance is Galbraith's idea that the leading role in management in modern society is shifting from top management to the technostructure (the totality of all specialists in the company). Science and technology in such a society become a means of asserting dominance, and the ruling class seeks to justify the development of society along the lines of its interests through the logic of scientific and technological progress.

Finally, American futurologist J. Naisbitt identifies in his works ten new global development trends, including the transition from an industrial society to an information society, from the development of technology – to the development of high technology, from a closed national economy – to an open global economy, from short-term planning tasks – to long-term strategic goals, from centralization – to decentralization, and progression towards the "technical progress – mental comfort" duality (Stoletov, 2017).

MATERIALS AND METHODS

The realization of the research goal is achieved by means of systematic and comparative methods, which reveal the factors influencing the formation and development of human capital. The article examines the content of the category "human capital" in foreign and Russian literature and draws attention to the structure and content of the definitions of social values and knowledge society. With the help of philosophical-axiological and anthropological approaches, an attempt is made to uncover the possibilities of educational practices and digital technologies in the process of human socialization. The materials used include scientific publications dealing with these issues.

RESULTS AND DISCUSSION

Evaluating Russian education (in terms of human capital development and the introduction of new technologies) over the previous half-century, it has undergone a serious metamorphosis, in which three stages can be distinguished:

1. The beginning of the era of digitalization (1970-1990). Over these two decades, the overall level of education and upbringing among schoolchildren and students increased substantially.

In the early 1980s, experimental classes appeared (the initial level of digitalization), where a significant part of school curriculum materials was presented using computers and educational and documentary film materials. The main contribution to the training of computer specialists was made by the Bauman Moscow State Technical University, the Moscow Institute of Physics and Technology, and the Leningrad Institute of Aircraft Instrumentation.

Moral and psychological means of influence (honorary boards, assemblies, raising respect for the teacher, etc.) came to the forefront of the educational process.

2. The period of the "wild" 1990s (1991-2000). Despite the all-permissiveness and the fall of trust in the authorities, schools continued to maintain a certain quality of education. During this period, the administrative elite destroyed the authority of any government, even their own, through their actions. Because they had been retelling official lies for decades, teachers suddenly became disrespected, and soft methods of psychological influence turned

ineffective. Despite the spread of personal computers in the country, their use in the educational process was ineffective at the time.

Private (alternative) educational institutions for children from high-income families have sprouted up in huge numbers. The attempt to create a more rigorous and high-quality education on their basis failed.

3. The recovery period (2000-2019). The problem of the revival of the educational system was largely expressed in the adaptation of the teaching staff to the new role of education as a service and to the new values actively adopted in society. The situation was further exacerbated by the arrival of young teachers whose worldviews had been shaped at a time of disintegration of the state and all-permissiveness. On the positive side, these young educators were influenced by the digital culture of the early 2000s with their diversity of outlooks.

At some point in time, students, same as society as a whole, developed a view of education as not the most important of activities. A career in science was no longer associated with life success in the usual, commonplace sense of the word, relating to the achievement of the desired level of consumption (Latova & Latov, 2020; Latov & Tikhonova, 2021).

Among the benefits of the strict centralized system in this area, typical of the USSR, we can note the high level of both secondary and higher education and the fact that many Soviet peoples received assistance from the center for the development of their economy and culture. Owing to the planned system of specialist training and the system of distribution of graduates, state funds allocated for the education system were usually paid back a hundredfold to the Soviet state, instead of financing the economies of other countries.

Meanwhile, the administrative-command system was too slow to adapt to change, struggling to respond to the peculiarities of local conditions, which led to the unification of the country's spiritual life. Many people associate it with the distant past, characteristic of the formation of traditional society. The effectiveness of this system was questioned already in the time of the USSR. Thus, despite enormous efforts for the ideological and spiritual-moral upbringing of youth, the Soviet administrative-command system became a fertile ground for double morality, an increased interest in the Western way of life, and even the worship of it.

Contemporary education system

The most notable of today's education system is the unlimited opportunities to improve the level of training of teachers themselves. In this way, the average level of teaching worldwide is increased by the openness and accessibility of the best curricula in the world's leading educational centers. Digitalization of education removes the distance between the teacher and the student and allows students to constantly communicate with foreigners on shared interests. Improved control and transparency of the educational process are steadily fighting corruption in the education system. There is also increased flexibility of training – the student can choose the duration and order of studying the materials, adapting the learning process to their needs and abilities by means of individual learning trajectories. The use of modern multimedia devices greatly simplifies and adapts the process of knowledge assimilation and skill formation.

As a result of employing scientific achievements and technology, the modern education system gains the variety and great volume of available information resources; free access to high-quality education; reduced costs of training owing to the abolition of paper carriers and the creation of electronic training aids; an effective solution to the problem of illustrative teaching, etc.

Schools and universities now use electronic documents and textbooks, programs for student surveys and testing, interactive whiteboards, and 3D printers. All educational institutions are actively transitioning to a new cloud-based information storage system. Currently under development are virtual laboratories. According to the developers' idea, this innovation will enable laboratory work and experiments, without the use of the necessary equipment and materials. Instead of physical laboratories, chemicals, and flasks, only virtual reality glasses will be needed (Vikhman, Romm, 2021).

The topic of the formation of the knowledge society has become extremely topical. This refers to the permeation of knowledge into all spheres of society and the economy, to a significant change in socio-economic structures.

The term "knowledge-based society", or "knowledge society", is defined in the 2003 World Science Forum documents as follows: "A knowledge-based society is an innovative and life-long learning society, which possesses a community of scholars, researchers, engineers, technicians, research networks, and firms engaged in research and in production of high-technology goods and service provision. It forms a national innovation-production system, which is integrated into international networks of knowledge production, diffusion, utilization, and protection".

Although the world does not yet have a developed model of such a society, its key characteristics and paths towards it are apparent. The main direction in the formation of this

new society should be the development of human capital (Alina-Andreea, 2020). The success of building the new society depends on a knowledge-based economy, in which the presence of a knowledge component in every product and service becomes a hallmark of human activity.

For modern mankind one of the important problems is the estimation of the place of science in the system of social relations, in cultural and intellectual life. Extremely relevant in this regard are such questions as:

- the balance between the freedom of scientific inquiry and the social responsibility of the scientist;

- the relationship between science and power, the possibilities and limits of governance of science;

- the nature of the consequences of scientific development, its humanistic essence.

The theory of post-industrial society by Bell (2004) developed in the framework of the social doctrine of scientism attempts to identify potential changes in the structure of society, develop effective tools for social forecasting, and give a social prognosis. Bell (2004), emphasizes that he draws attention to the rising influence of technology. The main issue for him is what social changes are produced by new technologies and what problems arise because of this in other systems, particularly the political. Thus, science-based technology is the driving force behind the development of society as a whole and its various elements in particular, whose degree of transformation varies considerably. An analysis of the socio-technological structure of post-industrial society is offered by Florida (2007).

The central sector of post-industrial society is the creative economy – an economy based on knowledge and operating on the basis of personal creativity and talent. According to Florida (2007), today's knowledge economy and value economy are being replaced by a creative economy. It is successfully created in a society based on subjective-idealistic approaches to reality, where everyone believes they live in their own world and see this world in their own way, where people are free to follow their dreams, even if those around them reject them. Creative industries assume not just the presence of new ideas, but their transformation into marketable products.

In "The Creative Class: People Who Are Changing the Future", Florida (2007), arrives at the following idea: "Today, members of the creative class need to see that their economic function makes them the natural — indeed the only possible — leaders of twenty-first century". Today, the main capital is no longer patents and other arrays of intangible assets, but people, who perform their economic function through a connection with intelligent technical systems, this "natural-artificial intelligence". The author believes that Russia has the second largest creative class in the world after the USA, where it makes up about 30% of all working Americans. Florida (2007), notes that the core of the creative class consists of people who "engage in complex problem solving that involves a great deal of independent judgment and requires high levels of education or human capital. In addition, all members of the Creative Class — whether they are artists or engineers, musicians or computer scientists, writers or entrepreneurs — share a common ethos that values creativity, individuality, difference, and merit" (Buzgalin & Kolganov, 2019; Latov & Tikhonova, 2021).

There are numerous explanations of the essence of human capital. They can be conditionally classified into three varieties, namely:

a) Predicative, which involve definitions that do not reveal the whole essence of the problem, but only touch upon the concept of human capital.

b) Resource-based interpretations, which are the most common in economics. Their essence is that the definitions contain information not on the capital itself but rather on resources that are not factors of creative activity.

c) Eclectic explanations characterized by a variety of different interpretations of the phenomenon in question. Specifically, they define human capital as both an element of national wealth and of society as a whole and as intangible human goods.

On the whole, all the described interpretations are quite useful for uncovering the social content of human capital and, importantly, objectively examining all aspects of the formation and development of capital.

Russian and foreign scientists alike predict the development of NBIC (Nano-Bio-Info-Cogno) convergence. At the core of the NBIC program lies the fundamental principle of the unity of the entire world at the nano-level. A convergent scheme is created, which presents a tetrahedron, in the vertices of which there are the primary elements: gene, neuron, atom, and bit, which become interchangeable. NBIC technologies give an unprecedented level of control over material objects down to their smallest structures. In the future, it will be possible to construct products needed by people at all available levels of organization of matter. From the very beginning, the NBIC project in the USA was joined by NASA, DARPA, and major companies such as IBM and Hewlett Packard.

Recently, the letter S is increasingly often added to the acronym NBIC to denote social sciences, without which

social control, humanitarian expertise of the results of scientific research, and their philosophical and methodological reflection are impossible. Material reality is connected here to the cognitive content of the human experience through technology. The main goal of such technologies is the human being itself, human health, longevity, and bodily and intellectual abilities (Ivanchenko, 2021). This will enable not just one, but a multitude of modifications of the human body, designed according to one's own wishes or needs. The NBICS convergence is triggering the most heated discussions on assessing the prospects of human beings and society in terms of the realization of its technological possibilities.

Currently, the ambitious Neuralink project is underway. The goal of the project is to connect a computer to the human brain. The computer will be able to interact with human memory and thinking processes and will have access to any information databases (Leshkevich, 2019). Neural interfaces will be used for commercial and medical purposes. Work in this direction is ongoing. The first prototypes already shown by Elon Musk are elastic threads through which information will be transmitted and a module that automatically integrates the threads into the brain. With the aid of an implanted microchip, a person will be able to augment their mental capabilities, using them for a multitude of other things. Mental anguish will become a thing of the past, humanity will learn to manage emotions, improve the ability to learn, and adjust behavior. People who have lost their sight and hearing will be able to live a full life due to the impact on neural connections. Paralyzed people will have the ability to move by controlling an external frame, an exoskeleton, with the help of implant sensors.

The disadvantage of such technologies is the possibility of unauthorized access to confidential information, even the consciousness of a huge number of people, and the possibility of control over individuals and the masses. Nevertheless, the progress of scientific thought is difficult to stop and the importance of medical applications of such technologies is beyond doubt.

The experience of China also shows that scientific and technological progress urgently demands the acceleration of social progress, which can be achieved both through the restructuring of social relations and through new forms of education, upbringing, and spiritual and moral improvement of people.

China's experience of the chipless connection of digital technology and work to improve people's social behavior began with the adoption of the social credit program through rating scores by the State Council of the People's Republic of China in 2014. Social credit is primarily driven by intangible assets. The credit system itself operates as a new stage of social relations, which reveal the critical role of information in economic, political, and social processes well shown in A. Toffler's book "The Metamorphosis of Power".

In 2020, a digital yuan appeared in China. The Chinese central bank reports that the digital yuan has already passed preliminary tests, and its development is nearing completion. It is expected that in the near future citizens will part with paper banknotes and switch to digital currency from the state, which will allow substantial savings on the production of paper banknotes, ATMs, and safes, to abandon the services of collectors, etc. After the development of the digital currency is completed and it is introduced into circulation, the country's leadership will not only know about every financial transaction in the country but also be able to issue loans exclusively to trustworthy citizens. The digital yuan will be closely linked to the social score system already in place in the country. Thus, the PRC is preparing to adopt another tool for building a perfect society – cryptocurrency.

The social credit system is also in practice in the EU and the USA. The European and American systems of collection of personal information are intended only for the formation of the credit rating of citizens and organizations. In the EU, the sole regulator of this rating is the interaction of the economic block of the government with the European Central Bank [22].

The PRC went much further. There the social score is used to calculate: the possible amount of credit and its interest rate; the amount of the insurance premium; the availability of Internet services; access to high-speed transportation; access to education and scholarships; travel abroad; access to public jobs; access to social services, etc. The social rating is based on three main components, in which a person can prove themselves, rated in points: the social, state, and network components.

The Chinese government has deployed an extensive social rating system that will track the actions of a vast number of both entities and individuals (at present, it covers more than 70% of the population) and give them ratings that will always be available online for anyone to read. The social score is even used on Chinese dating sites (for example, the Baihe site recommends that all members indicate their social score) (Cook, 2019).

Information on a citizen's deeds is collected from 150 organizations and then processed using Big Data technology. The system is designed to help Beijing build a communist society of citizens whom the Party has made trustworthy with the help of digital technology. Since January 2021,

the Chinese Civil Code has already adopted the social credit system, with each person initially endowed with a social rating of one thousand points. After that, the unified information center began to analyze each citizen by various parameters, of which there are more than 150 thousand. If a Chinese citizen reaches a social rating of 1,050 points through daily good deeds, they are awarded the status of an ideal citizen, to which all 90 million members of the Chinese Communist Party certainly aspire.

What raises one's social score are socially useful deeds and actions that strengthen social ties (helping the poor and the elderly, good relations with neighbors, etc.).

CONCLUSIONS

The presented study substantiates the necessity and pertinence of changes in human capital management through the modernization of secondary and higher education. The timeline of major trends in Russian education over the past 50 years is described. The principal difference between modern technologies and their predecessor models in the context of human biological and socio-cultural evolution is analyzed. The essence of the systemic challenge to human civilization posed by new scientific developments and technologies and the level of influence produced on these processes, in particular, by digital technology, is disclosed. The authors describe further pathways for the development of human capital on the example of advanced practical developments in China and the USA.

The conducted research uncovers the factor that, in our view, presents the main hindrance to the innovative development of the economy, namely the poor level of development of human capital, which owes to the inadequate quality of education and the high rate of obsolescence of knowledge and professional skills. The same applies to the general understanding of human capital and the choice of methodology for its research and methods of development. The diversity of approaches to the study of human capital explains the multifaceted nature of this concept and gives reason to define it as the central element in the development of socio-economic relations at the present stage.

The main driver of development in the scenarios of the future is derived from the potential of each individual. The article justifies the need for a new model of social development occurring under conditions of unpredictability associated with the rapid development of the information and technological sphere of society.

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