

# Factors affecting the quality of human capital in industrial cities of Russia

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**Abstract.** The study tests the hypothesis that in order to develop industrial enterprises in the modern realities of the BANI-world (brittle, anxious, nonlinear, incomprehensible: fragile, disturbing, nonlinear, incomprehensible) it is of high importance to understand the influence of the social context and assess it in the correct manner. To reach new heights of development, not only direct investments in people's education are needed, but also indirect ones, i.e., in creating favourable living conditions. The purpose of this work is to identify the factors that are the target of indirect investments affecting the quality of human capital in industrial cities of Russia.

**Key words:** Human capital; Industry; Fuel and energy sector.

## 1 Introduction

In an ever-changing world, it is very important for companies to have a foothold. The main support of this is the company's capital. With the transition to digital technologies, human capital is becoming increasingly important for enterprises. Human capital is a complex system. It consists of such characteristics as people's abilities, their knowledge, experience, skills and abilities. Also, it is worth noting such factors as health and standard of living. People are generators of ideas and new technologies.

The fuel and energy complex (fuel and energy complex) is also a complex intersectoral system for the extraction, production and transportation of fuel and energy, as well as for their distribution and use. The development of the fuel and energy sector depends on the scale and technical and economic indicators of public production, primarily industry. The fuel and energy sector is one of the main employers in Russia: there are more than 200 large companies and more than 2 million employees in the fuel and energy sector. The fuel and energy complex is the basis for the development of the Russian economy: it is an instrument of domestic and foreign policy, 20% of GDP, more than 40% of budget revenues to the treasury and 50% of Russia's exports.

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The correlation of these two systems carries with it the possibility of enormous development and transition to a new level of development of both the fuel and energy complex and the economy of the country as a whole, as well as the construction of a new system that takes into account current ESG factors and the implementation of the federal project "Digital Energy", which includes the transformation of the energy infrastructure of the Russian Federation through the introduction of digital technologies and platform solutions to improve its efficiency and security.

Human capital has been studied for many years, and numerous publications have been devoted to its assessment. At the same time, the question of filling the very concept of "human capital" remains open. For the fuel and energy sector, the territorial availability of qualified personnel, potentially capable of working and developing this industry, is important. Very often, fuel and energy companies are located in unfavourable territories for living. The question of the ratio of environmental factors for human capital in this case is one of the main ones.

## 2 Methods

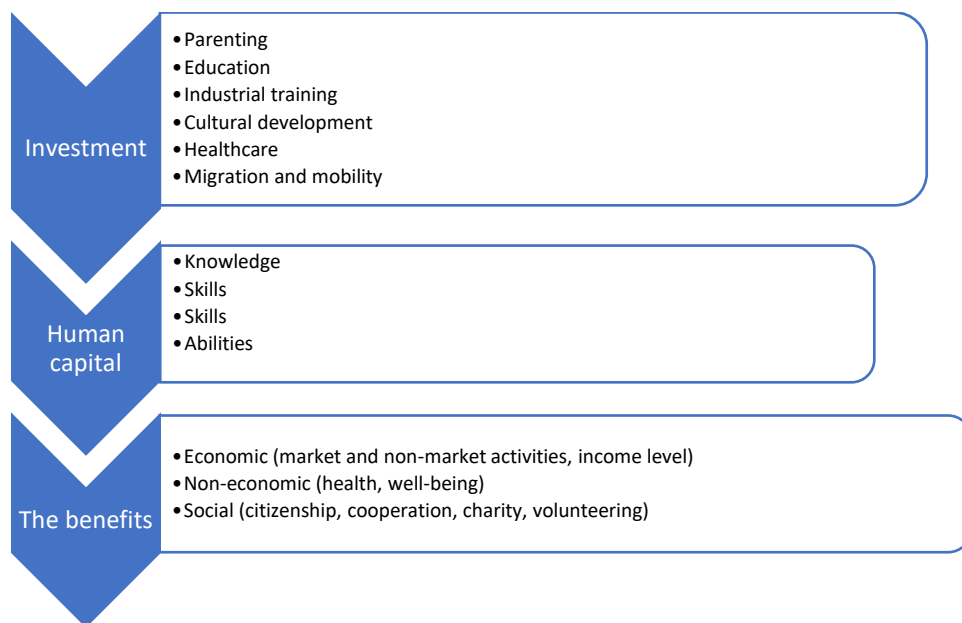
In the course of the research, the method of analysing literature and quantitative data was used. Russian and foreign studies were analysed, selected according to the following keywords: "human capital assessment", "methods of human capital assessment", "approaches to the definition of human capital". Quantitative data on the population were taken from the website of the Federal State Statistics Service ([rosstat.gov.ru](http://rosstat.gov.ru)), data on the environmental rating of industrial cities in Russia from the website [www.domofond.ru](http://www.domofond.ru) (Environmental rating of 200 Russian cities for 2019).

According to the Human Capital Index published by the World Bank, Russia ranks 41st out of 174 countries in the world [1]. This indicator is provided mainly due to the well-established accessible educational system.

The study of human capital was initiated by Schultz [2] and Becker [3]. They laid the foundations of the theory of human capital. In recent years, many scientists have continued their research [4-9]. Scientists consider in their research the importance of human capital for economic growth: within individual enterprises and within the region. Currently, "human capital" is a recognized economic category.

Within the framework of this study, we will focus on the following definition: "Human capital is a set of intelligence, skills and experience that give an organization its destructive character. The human elements of an organization are able to learn, change, innovate and provide a creative impulse that, with proper motivation, can ensure the long-term survival of the organization"[10, 11].

An analysis of the literature has shown that despite long and comprehensive studies of human capital, there is no conceptual unity among scientists. This is especially evident when considering the economy from different points of view. From one point of view, human capital is defined as the sum of potential income [12, 13]. From another point of view, human capital consists of the totality of the costs of a person's education, his health, the time spent on acquiring skills and abilities, as well as the ability to accumulate information and process it later [14, 15].



Compiled on the basis of "Guidelines for measuring human capital". United Nations. [https://unece.org/fileadmin/DAM/stats/publications/2016/ECECESSTAT20166\\_R.pdf](https://unece.org/fileadmin/DAM/stats/publications/2016/ECECESSTAT20166_R.pdf)

**Fig. 1.** The scheme of formation of human capital, its components and the benefits provided by it.

In addition to wealth creation, people also need healthcare, recreation, social media, education, skills training and other support activities. The availability of these services depends on the investment. Some of these activities are the main components of the household economy and the modern economy [16-20], while others cause serious public concern [21-23], such as healthcare. In the conditions of COVID-19, safe, convenient and well-equipped medical institutions are more favourable for people's lives [24], and countries and regions are more favourable for supporting their growth. However, there is a shortage of investments in schools and medical institutions that directly serve human development. Very often, the government is caught between concern for public welfare and economic returns. According to Marshall [25], "the most valuable of all capital is the capital invested in people." There is an urgent need to consider investments in human development and new ideas in order to understand the spatial consequences of people and economic relations [26].

Human capital is evaluated by various methods. This is stated in the research [14, 27-30]. It is important for industrial enterprises to have data on potential employees. Studies [31-34] talk about the possibility of assessing human capital both at the enterprise level and at the regional level. It is assumed that the existing internal mobility of the population will make up for the lack of employees in a particular territory.

It is also important to note the dependence of the evaluation method on the interpretation of the concept of "human capital" [35].

### 3 Results

In the process of analysing the literature, it was noted that research pays little attention to the criteria for the qualitative development of human capital [36-38]. Many studies describe quantitative and cost estimates [27, 28, 35]. If we consider the overall development of a

certain territory, for example, an industrial city, it is necessary to take into account the factors affecting the "human capital" when creating a strategy for the development of the territory. There is a study that considers the possibility of using the municipal budget as a tool for the development of "human capital". At the municipal level, the possibility of interaction between enterprises, authorities and trade unions is more realistic [39]. We believe that this interaction is able to conduct an intra-city checkup of factors affecting the development of human capital. As well as to organize conditions to meet the needs of industrial enterprises and the needs of the population.

We propose a list of the main factors influencing the development of human capital (Table 1).

**Table 1.** Factors influencing the development of human capital within an industrial city.

Factor	Decoding	Safety measures
Economic conditions: recession or a period of high inflation	Job cuts in difficult times or a decrease in the purchasing power of the population	Development of an active database of jobs Development of trade relations Tracking the ratio of the level of inflation and the level of wages
Digitalization of production processes	Improving the efficiency and productivity of employees Reduction of jobs automated by new technologies	Development of the education system
Environmental and social problems	Environmental well-being in the city Safety precautions within the company	Development of control functions of environmental committees Carrying out preventive measures within enterprises
Changes in legislation	The development of labor legislation in terms of guarantees of benefits, compensation and labor protection at industrial enterprises and the organization of work in a difficult climate	Preservation of benefits and compensations already available in legislation, development and development of preventive and incentive measures within the city.

The factors presented in table 1 are external to the industrial enterprise, but these factors are internal to the industrial city. Understanding the sensitivity of human capital to changes in environmental parameters is important for decision makers. In the industrial sector, the speed of decision-making is a rather laborious process: it is necessary to take into account the colossal amount of information, which is due to the specifics of the activities of enterprises and products [40]. For smooth operation, high-quality personnel are needed both for management and for the production process. By identifying vulnerabilities, stakeholders will be able to develop strategies to mitigate the negative impact of external changes on the dynamics of human capital. Also, these strategies will allow you to benefit from the positive changes from attracting and retaining talent in the city. The high-quality personnel potential formed around a large industrial enterprise will have a direct impact on the level of culture of the population as a whole.

**Table 2.** The ratio of the ecological rating of industrial cities in Russia with the population.

Position in 2019	Grade in 2018	Grade in 2019	City	Population size	Industries in the territory
30	7.1	7.6	Tyumen	855 618	Oil and gas industry, mechanical engineering, metallurgy and food production
62	6.6	7	Neftekamsk	133 300	Mechanical engineering, fuel, oil industry, electric power industry, light and textile industry, food and processing industry
84	6.8	6.8	Perm	1 027 153	Electric power and fuel industry, heavy machinery
92	7.2	6.7	Surgut	406 938	Oil production, oil industry, electric power industry
105	6.2	6.6	Ufa	1 157 994	Oil production, oil refining, petrochemical and chemical industry, oil and gas transportation, metallurgy
115	7.1	6.4	Nizhnevartovsk	287 095	Production of oil and associated petroleum gas, mechanical engineering and instrumentation, production of building materials
117	6.5	6.4	Ekaterinburg	1 539 371	Metallurgy, instrument making, optical and mechanical industry, heavy machinery, printing industry, light and food industry, heat and electric power industry
156	5.9	5.5	Novy Urengoy	106 764	Gas production industry
191	4.5	3.9	Leninsk-Kuznetsky	90 412	Coal industry, mechanical engineering, chemical industry, food industry and production of building materials
192	—	3.9	Novokuibyshevsk	97 163	Oil refining, production of petrochemical products, production of catalysts for oil refining and petrochemistry
193	3.4	3.9	Klin	88 525	Glass industry, food industry, construction materials production, chemical industry, light and textile industry, pulp and paper industry
194	5.2	3.9	Prokopyevsk	174 859	Coal industry, machine building, light and food industry
195	5.3	3.9	Pervouralsk	112 860	Ferrous metallurgy, mechanical engineering, metalworking, chemical and food industry
196	—	3.6	Yakutsk	361 154	Fuel and energy complex, food industry, diamond cutting production, production of building materials, metalworking industry
197	4.7	3.6	Vorkuta	56 389	Coal industry and electric power industry
198	—	3.4	Belovo	67 950	Coal industry, production of equipment for the construction, woodworking, furniture and advertising industries
199	3.8	2.7	Kiselevsk	81 887	Coal industry
200	2.5	1.9	Norilsk	174 747	Mining, non-ferrous metallurgy, energy, construction production, food production

One of the illustrative examples of the use of city power is the ecological state of the city. For a comfortable and healthy life, a person needs an optimal environment

characterized by the natural state of nature. Industrial cities are always classified as the most polluted cities. Table 2 presents data on some cities in Russia, mainly with fuel and energy companies: environmental rating of these cities, types of industry in these cities and population. The presented list is formed in an expert way, but even with a superficial analysis, it can be seen that 80% of the total population of cities from Table 1 live in the first seven cities with the best indicators for environmental rating. This indicates the importance of this factor for the development of human capital within the city.

## **4 Discussion**

The presented factors correlate with the majority of studies available on the assessment of human capital. We believe it is necessary in subsequent studies to create a platform basis for calculations by considering additional basic categories.

To analyse the interrelationships between various factors affecting the quality and development of human capital in industrial cities, it is necessary to develop indicators for evaluating the following criteria: the quality and accessibility of technical and vocational education programs, the compliance of these programs with the changing requirements of the sector and the effectiveness of training programs for existing workers in sector, the unemployment rate, local initiatives for economic development and the presence of other industries.

The analysis of these categories will help to gain a more complete understanding of the dynamics of human capital in industrial cities of Russia and serve as the basis for strategies to improve the quality and development of human capital in the industrial sector, including in the fuel and energy sector. This concept will help policy makers and industry leaders identify areas for improvement and prioritize investments in education, training, ecology, urban well-being, technology and sustainable development.

## **5 Conclusion**

The main result of this study is the identification of external factors affecting human capital and its development, which are the purpose of indirect investments. Financing and paying attention to these factors will create an environment for the development of people with the qualities, knowledge and skills necessary for the development of enterprises of the fuel and energy complex. Based on the identified factors, directions for further research will be developed. At the next stage of the study, the factors will be considered on the example of cities where enterprises of the fuel and energy complex are located. It is planned that the relationship of human capital with factors will be confirmed. Recommendations on the development of the identified factors were also developed.

The assessment and the possibility of adjusting human capital is the most important task for the fuel and energy complex. This will help identify the strengths and weaknesses of the company's staff and develop strategies for attracting, developing and retaining talented employees.

Thus, this study recommends intensive efforts to develop a platform of indicators to create a comprehensive human capital assessment system for different levels: enterprise, city, region.

Moreover, according to the results of the study, it is recommended to develop the interaction of authorities, representatives of fuel and energy complexes, environmental committees and representatives of educational organizations. This cooperation will make it possible to comprehensively identify existing problems within the industrial city.

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