

Assessment of Human Capital from the Perspective of Investment Costs

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Abstract—The article presents theoretical foundations for the formation of human capital with reference to the modern transformation of existing concepts. Methodological approaches to its quantitative assessment with regard to the content of the studied object and the possibility of placing it into the perspective of mathematical measurability are considered. The conceptual foundations for the depreciation of human capital are studied and mechanisms underlying its algorithmization are investigated taking into account the stages of the life cycle and the trajectories of changes in its components. The methodology for the valuation of human capital in terms of investment costs is presented and tested. The analysis of changes in the quantitative value of human capital in the context of social guidelines set in Belarus is performed. The level of its depreciation is assessed taking into account the pension coverage of the population. The structural imbalances in the national wealth of the Belarusian economy are revealed based on the ratio between estimated human and physical capital.

Keywords: human capital, methodology, cost approach, depreciation, valuation, social guidelines, innovation-driven development

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Conceptual foundations for the theory of human capital. The intensification of innovation-oriented development processes based on the interaction of all forms of capital has had a significant impact on investigation into the problems of its human component. Representatives of this direction focus on the increment of technological new developments, the transformation of which into innovations, as well as the improvement of human capital, is one of the main tools for progressive development [1–3]. Despite the high practical orientation of this approach, the lack of a unified generally accepted methodology for the quantitative assessment of human capital to a certain extent limited its interpretation as a renewable source of sustainable economic development.

As an economic category, the concept of “capital” is characterized by a value expression that makes it possible not only to assess its real value but also to compare its various types and constituent elements. Human capital is endowed with similar parameters, which in the process of consuming its value is subject to wear and tear, necessitating the financial recovery of these losses. At the same time, human capital is gradually accumulated through intangible investment embodied in additional benefits, knowledge, and experience. A distinctive feature of the depreciation of human capital and its nonmaterial component is its nonuse due to unemployment or ineffective inappro-

appropriate use. This feature is due to the specificity of human capital, which manifests itself in an additional increase in knowledge and skills as a result of intensive consumption.

Methodology for assessment and its analysis. The variety of methodological concepts for the valuation of human capital conditionally forms two approaches: direct and indirect. One of the options for the latter is to determine its value by the residual method, the essence of which is the identity of the discounted value of the benefits generated by human capital during its service life and its current monetary value. This method has become widespread in the context of the controversy about sustainable development, as a result of which the total volume of capital assets at the national level is considered as a source that reproduces the flow of consumer goods in the future. The discounted value of future consumer flows takes the form of an approximate indicator of the total national wealth. Further, by deducting from this amount the valuation cost of capital goods (fixed assets, natural resources, net foreign assets), the residual (indirect) value of capital stocks in value terms is determined [4, 5].

Experts of the World Bank were among the first to use this method to quantify human capital in several countries. The main advantage of this approach is the availability of the underlying statistics. At the same

time, the residual method does not take into account the nonmarket benefits of capital assets and is also characterized by a high error of measuring the constituent elements of the sought identity, which leads to systematic inaccuracies in determining the resulting value of human capital. In addition, the residual principle of quantitative assessment does not allow interpreting the reasons for the change in human capital over time and isolating its value from the total set of intangible assets.

An inversion of the indirect approach to assessing human capital is a direct one, a variation of which is the cost approach, based on the summation of the costs that ensure human vital activity. There are several methods for the valuation of human capital. In particular, the direct method can be classified into the cost (investment) and income approach. Here, the essence of the cost approach is revealed. In this case, the valuation of human capital proceeds from determining the residual value of costs aimed at investing in its development in current prices. Current prices imply the use of real data in order to generate empirical estimates for a specific date. The stock value of human capital is determined taking into account its disposal, the decrease in its value during operation, which is identical to the depreciation of fixed capital. In other words, the valuation of human capital based on the considered approach is performed by summing the net real costs of "producing" assets of different age groups [6, 7].

One of the first attempts at the valuation of human capital was made by W. Petty who defined the value of an individual of working age as a value identical to twentyfold annual income [8]. The classics of economic theory noted the need to take into account human capital when determining the amount of national wealth, explaining this by its impact on the labor productivity and gross income of the state. D. Ricardo in his studies used the term "expenses of labor reproduction" [9]. A. Smith explained the differences in workers' wages by the differentiation of material, labor, and time costs due to mastering skills and gaining experience [10].

The development of the human capital theory focusing on the investment component has expanded the horizon for comprehending the expenditure component. The founder of this concept, T. Schultz, pointed to the need to allow for missed benefits obtained in the process of off-the-job training. The progressiveness of his judgments consisted in interpreting content of training costs as the investment basis of the human capital formation [11, 12]. J. Kendrick's significant contribution to the development of a cost method for the valuation of human capital was the differentiation of material costs determined by the quantitative reproduction of human resources and nonmaterial expenses providing funding for the basic living conditions of the population [13].

Integrating the abovementioned ideas in the context of quantification makes it possible to express human capital valuation by a system of costs associated with obtaining education. However, this approach does not take into account the loss of the value of human capital (like a physical analog) in the process of its functioning. Tangible assets are characterized by high returns at the beginning of their operation, while the return on capital of human potential increases over time [14, 15]. Human capital is characterized by a certain specificity of manifestation and changes in the form of its "obsolescence." By analogy with material assets, physical wear is determined by the degree of natural aging of the human body and its inherent psychophysiological functions. In the study [16], this is called "technical obsolescence of human capital," which negatively affects the level of workers' qualifications.

No unified concept regarding the rate of obsolescence of human capital has been developed up to now. Some researchers believe that a twenty-year period of professional activity triggers the phase of moral and physical deterioration of existing knowledge, skills, and competencies accelerating the process of human capital devaluation, as a result of which the end of employment is associated with complete depreciation of the accumulated experience [17, 18]. At the same time, knowledge and experience do not lose their value, accumulating over time, increasing the value of human capital; in this regard, the intellectual stock of an individual is little subject to absolute wear and tear.

The concept of "depreciation" as a value expression of the human capital negative change in the broadest interpretation performs the following main functions: estimation, the essence of which is manifested in determining the amount of losses due to the exploitation of human capital, calculation expressed through a system of coefficients that are an integral part of the methodology for determining the value of human capital, and investment expressed in the form of its subsequent recovery. In this context, the value of depreciation is an integral component of the methodology for the valuation of human capital and characterizes the amount of losses due to both physical wear and tear and the possibility of its recovery in the process of natural obsolescence.

According to some authors, depreciation of human, as well as physical, capital, is manifested to a greater extent in the process of gradual loss of the value of this asset. Based on this, the trajectory of its change is inextricably linked with the life cycle of an individual, that is, age differentiation. The age gradation of human resources will have a direct impact on the intensity of changes in the depreciation curve: at the initial stage of the life cycle of human capital formation, the rate of its decline will be insignificant. In the time following, this process will be characterized by linearity, due to the stability of obtaining, consolidat-

ing new knowledge, and its timely updating. With an increase in the age of an individual, depreciation of human capital will acquire a nonlinear form due to the loss of the relevance of existing skills and knowledge, as well as the emerging difficulties associated with adaptation to innovative transformations [15, 19–20].

Quantitative assessment of human capital. In accordance with the approaches of the above methodology, the quantitative assessment of human capital can be represented by a system of costs that reveal the processes of financing its formation and development. Analysis of the available statistical indicators allows us to interpret them through the prism of indicators characterizing state budgeting of the social sphere (including housing and communal services and construction) as well as consumer spending of the population, excluding the cost of purchasing alcohol and tobacco products. On the whole, consumer expenditures accumulate household expenditures for food, purchases of essential nonfood items, and payments for various social services. Taking this into account, the proposed system of indicators reveals how human capital accumulates from the viewpoint of the social guidelines laid down in the government policy of the state. Budgeting of social expenditures forms the basis for creating an economic platform for increasing human capital while consumer costs reflect the capabilities and desire of the population for its accumulation. In this regard, the costs of purchasing alcohol and tobacco products as expense items that prevent the formation of positive human capital must be excluded [21].

It should be noted that the definition of depreciation norms (rates) is the cornerstone of the cost methodology. Taking into account the multicomponent composition of human capital, the factors that determine the process of its depreciation are to be multidirectional. In particular, health capital and labor capital as elements of human capital, all other things being equal, will, over time, intensify the processes of an individual's natural aging and a decrease in its capitalization. In combination with the level of productivity, which determines the profitability of human capital, the intensity of physical wear and tear will somewhat slow down [22, 23].

The concept of human capital depreciation from the viewpoint of the innovation-oriented mechanism of its reproduction reflects the process of accumulating resources in order to ensure the recovery of previously lost value. In this context, the replacement function of human capital depreciation will reflect the possibility of its replacement required due to wear and tear. When integrated into the reproductive system providing sustainable accumulation of human capital, the replacement concept of depreciation will characterize not so much the level of losses as the value of the accumulated potential. The theoretical essence of this methodological approach is to provide an economic assessment of accumulated human capital deprecia-

tion by analyzing indicators reflecting the possibilities of its reproduction during periods of a slowing capitalization process associated with a decrease in working capacity. As a rule, this time interval goes beyond the working age, and, therefore, the costs of renovating human capital are determined by the level of pension provision. The latter accumulate in themselves, on the one hand, the specific value of capitalized human potential, and on the other, the level of financial security during gradual loss of human capital value. Thus, the size of the pension provision to some extent characterizes the possibility of its circular reproduction.

If we take as a basis the established practice of assessing human capital through the prism of costs for its formation, then the ratio of current pension payments and aggregate budgetary and consumer expenditures allows us to quantify the level of human capital depreciation in order to determine its value (Table 1).

The analysis of the results shows a significant increase in the quantitative value of human capital in Belarus, which is largely due to its assessment at current prices. The use of actual data predetermines the need to analyze the structure of human capital and the degree of impact made by the factors that determine its value, however, it somewhat distorts the real dynamics of its change. This error is eliminated by obtaining the calculated value in constant prices (Fig. 1).

The elimination of the inflationary component in the trajectory of the estimated value of human capital makes it possible to display the real picture of its change. Compared to the estimate in current prices, the comparable estimate of the calculated values is significantly lower, the intensity of the increase is significantly lower, although their growth by 1.7 times over the past 10 years is recognized. Despite a significant gap in the estimated data, in general, it should be noted that the government economic policy has become more socially oriented, the result of which is an increase in human capital and an expansion of opportunities for capitalizing its potential.

Depreciation of human capital. As already noted, one of the most important points of the methodology for assessing human capital using the cost approach is accounting for depreciation. The advantage of the presented approach is the possibility of not only calculating it but also determining the level of wear, which is a necessary condition for assessing the effectiveness of social guidelines and determining the directions of their change (Fig. 2).

According to the presented data, the trajectory of changes in the loss of the human capital value is subject to significant fluctuations. Despite the fact that over the past decade the level of human capital depreciation in Belarus has slightly decreased, in the current retrospective its increase is actually observed. Together with the increase in the retirement age and, accordingly, the period of working capacity, the current trend is an alarming indicator characterizing a

Table 1. Indicators for assessing human capital from the standpoint of investment costs, million rubles

Indicator	2012	2013	2014	2015	2016	2017	2018	2019
Budget social expenditures	6451.7	7857.6	9052.4	10642.6	11841.0	12605.0	14099.0	16055.0
Budget expenditures on housing and communal services and housing construction	1208.4	1589.4	1730.5	1613.4	1517.0	1582.0	1961.0	2139.0
Household consumer spending	16658.0	22197.5	27429.2	30411.4	32961.2	37265.9	43421.6	48696.9
Depreciation of human capital	114.7	182.3	357.3	426.4	509.0	544.9	580.0	612.3
Estimated value of human capital at current prices	24318.1	31644.5	38212.1	42667.4	46319.2	51452.9	59481.6	66890.9

Source. Calculated by the author based on statistical data for Belarus¹.

decrease in the accumulated value of the human capital stock.

The depreciation of human capital has a direct impact on the rate of its reproduction, the intensity of which predetermines the dynamism of the innovative development in the economy. The number of pensioners, as well as the average size of granted pensions, predetermines the amount of the corresponding payments and characterizes the amount of potential accumulated depreciation of human capital. The revealed trends for changes in these indicators determine the dynamic loss of its value. Despite an increase in the number of pensioners in 2019 compared to 2012 by 20000 people (0.8%), since 2016, there has been a decrease by 87000 people (3.3%), which is due to both demographic factors and adjustments to the regulatory retirement age in Belarus. The latter means an increase in the period of capitalization of human potential.

Analyzing the dynamics of changes in the number of working pensioners, a similar trend can be noted: since 2016, their number has decreased by 32000 people, or 4.8%. The identity of the patterns of changes in the number of both working and nonworking pensioners testifies to the highest capitalization of the human potential in the working age, beyond which there is a significant decrease. This suggests that, despite the accumulative system for the formation of human capital, the possibilities of transforming the latter into the most liquid assets are limited by age restrictions. This circumstance makes it necessary to exclude persons who continue to work from the total number of pensioners. They, being active participants in the labor market, capitalize their potential and ensure its growth.

Human capital in the structure of the national wealth of Belarus. In the modern world, the rate and the very concept of scientific and technological progress are determined not so much by its materialized content,

which is to a greater extent the result, but by the capacity of accumulating human potential, which is transformed into knowledge, innovation, and capital. Based on this, the predominant factor in the progressive development of the economy is the human component of national wealth, the ratio of which in mag-

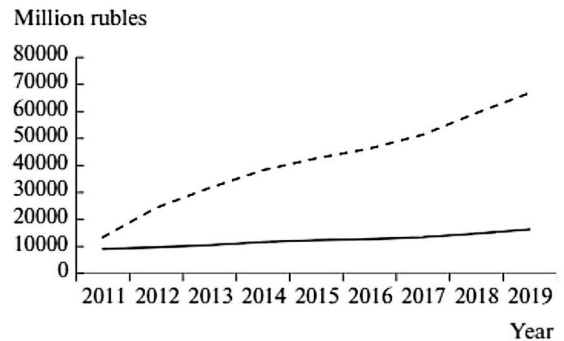


Fig. 1. Dynamics of changes in the estimated value of human capital in current (---) and constant (—) prices in 2010.

Source: calculated by the author.

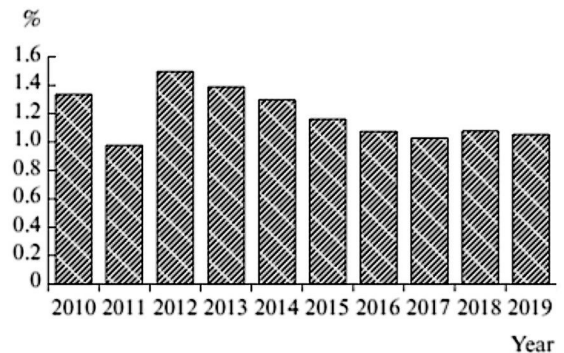


Fig. 2. Depreciation rate of human capital.

Source: calculated by the author.

¹ Statistical Yearbook of the Republic of Belarus, 2020 // National Statistical Committee of the Republic of Belarus. Available at: https://www.belstat.gov.by/ofitsialnaya-statistika/publications/izdania/public_compilation/index_18023/ (accessed 21.06.2021).

nitude to the physical analog allows us to assess the activity of innovative shifts in the economy (Fig. 3).

The graphical data illustration in Fig. 3 reflects a slight increase in the specific value of human capital in relation to the value of fixed assets. The latter, constituting about 90% of the country's national wealth, form its material platform and characterize the degree of capital intensity. A quantitative assessment of human capital reveals its intangible component and, to a certain extent, reflects the susceptibility of the national economy to innovation. The presented picture reflects the current projection of the socio-economic development in Belarus. Despite high standards and social strategic guidelines, the main tilt of state policy is manifested in the accumulation of material wealth, the value of which is more than five times greater than the size of human capital.

The relative stability of the existing relations testifies to the high capital intensity of the national wealth of Belarus, the structure of which is weakly subject to innovative transformations. Human capital, accumulating knowledge, new developments, and innovations, projects technological shifts in the economy, ensuring the achievement of sustainable growth through transformations of capital forms. In contrast, the relatively higher capitalization of tangible assets acts as a deterrent to progressive scientific and technological development (Fig. 4).

According to the presented data, GDP over the studied period increased by 5.1 percentage points, and labor productivity by 14.2, the number of people employed in the economy decreased by 7.6 percentage points, and fixed assets increased by almost a quarter (by 24.1 percentage points). The performance of the main macroeconomic proportions indicates that economic growth is ensured through an active increase in fixed assets with a significant decrease in the number of the employed population. The current situation is evidence of the extensive development of the national economy aimed at achieving quantitative parameters due to the scale effect.

Alongside its positive effects, enhancing the capital intensity of the national economy has its drawbacks. Such a structure of national wealth is rather inactive, weakly susceptible to structural deformations due to the intensification of innovative transformations. Human capital compiles the capitalization of scientific and technological innovations and produces their increment, thereby absorbing tangible assets, transforming them into an intangible form.

The realities of the modern world and benchmarking of the innovative guidelines of the leading world powers indicate the need for such transformations [24–25]. The investigations conducted into the system of factors that determine the effectiveness and progressiveness of the development of Western European countries and the United States indicate the prevailing influence of human capital on this process. A high sus-

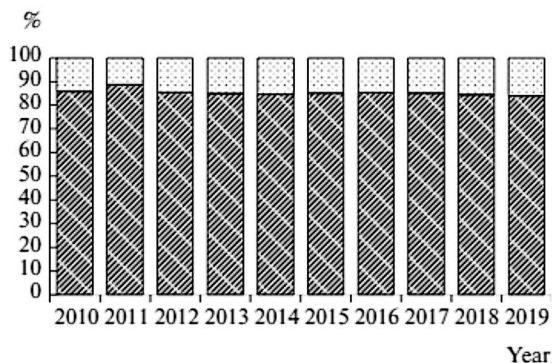


Fig. 3. The ratio of estimated fixed capital and human capital: ▨ fixed capital; □ human capital.

Source: calculated by the author.

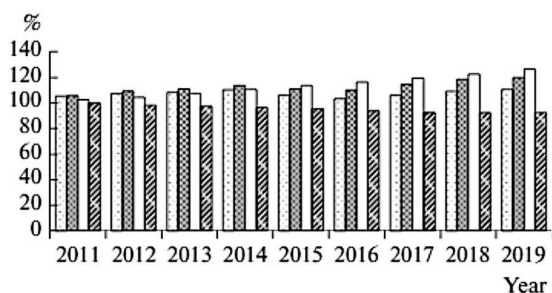


Fig. 4. Dynamics of the main indicators of socio-economic development of Belarus in 2011–2019, % to 2010: □ gross domestic product; ▨ labor productivity to GDP; ▤ fixed assets in the economy; ▩ annual average size of the employed population in the economy.

Source: statistical data for Belarus².

ceptibility to innovative transformations led to a modification in the structure of the national wealth of these powers.

Improving the methodological foundations of the theory of human capital development is an integral part for the concept of sustainable development of the country's economy. An individual in the modern world is not so much a production resource as a progressive form of innovative capital, the productive use of which contributes to its accelerated self-reproduction on an extended basis. Improving the management of this resource, on the one hand, acts as a strategic goal of sustainable development of any economic system and on the other hand, as a tool for its effective management. A quantitative assessment of human capital makes it possible not only to coordinate the directions of socio-economic and innovation-invest-

² See footnote 1.

ment development of the country but also creates a methodological basis for the implementation of cross-country comparisons, analysis of the progressiveness of innovative shifts, and assessment of transformational reforms.

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