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## IMPACT OF RUSSIAN MILITARY AGGRESSION ON THE DEVELOPMENT OF HUMAN CAPITAL IN THE REGIONS OF UKRAINE

*The article examines the impact of Russian military aggression in 2014 on the development of human capital in the regions of Ukraine. The author's understanding of the socio-economic category "human capital" is presented. In order to build an integral indicator of the level of development of human capital in the region, it is proposed to consider the following structural components and partial primary diagnostic indicators of this capital: economic-demographic component, educational-scientific component, medical-biological component, socio-cultural component. Due to the fact that before and after the full-scale invasion of Russian troops into Ukraine on February 24, 2022, the available statistical data on this capital in open sources are not the same, the research was carried out on the basis of annual data only for the years 2013–2020. The article examines this influence using an approach that consists in using the methods of multidimensional statistical analysis, in particular, the method of constructing an integral summarizing indicator, to perform calculations. The results of the study showed that the Russian military aggression in 2014 had a significant negative impact on the development of human capital in the regions of Ukraine.*

**Keywords:** human capital, Russian military aggression in Ukraine, region, integral generalizing indicator, components of human capital.

**JEL classification:** O15, C80

## ВПЛИВ РОСІЙСЬКОЇ ВІЙСЬКОВОЇ АГРЕСІЇ НА РОЗВИТОК ЛЮДСЬКОГО КАПІТАЛУ В РЕГІОНАХ УКРАЇНИ

*У статті досліджено вплив російської військової агресії 2014 р. на розвиток людського капіталу в регіонах України. Подане авторське розуміння соціально-економічної категорії «людський капітал». В роботі запропоновано для побудови інтегрального показника рівня розвитку людського капіталу регіону розглянути такі структурні компоненти і частинні первинні діагностичні показники цього капіталу: економіко-демографічна компонента, освітньо-наукова компонента, медико-біологічна компонента, соціокультурна компонента. Процедура кількісного оцінювання рівня розвитку людського капіталу регіонів України потребує наявності статистичних даних вищевказаних частинних первинних показників, які характеризують цей капітал. У зв'язку з тим, що до і після повномасштабного вторгнення російських військ в Україну 24 лютого 2022 року у відкритих джерелах наявні статистичні дані про цей капітал є неоднаковими, то дослідження здійснювали на основі щорічних даних тільки за 2013–2020 роки. В статті досліджено цей вплив з використанням підходу, що полягає у використанні для виконання розрахунків методів багатовимірного статистичного аналізу, зокрема, методу побудови інтегрального узагальнюючого показника. Для виконання розрахунків і побудови інтегрального показника бажано, щоб вибрані для цього первинні показники мали високий рівень варіації, а коефіцієнт кореляції для будь-яких двох з них був невеликий. Ураховавши вказані обмеження, при виконанні розрахунків з даного переліку показників було вилучено такі з них: кількість працівників, які підвищували кваліфікацію; кількість фахівців вищої кваліфікації, зайнятих в економіці країни (кандидати та доктори наук); середня очікувана тривалість життя при народженні; місць у залах для демонстрування фільмів. Результати дослідження показали, що російська військова агресія 2014 р. мала суттєвий негативний вплив на розвиток людського капіталу в регіонах України. За період з 2013 по 2020 роки величина показника «рівень розвитку ЛК» зменшилася для тих регіонів у яких він був найвищим і збільшилася – для тих у яких він був найнижчим. Тобто диференціація величин цього узагальнюючого показника для регіонів України за досліджуваній період зменшилася.*

**Ключові слова:** людський капітал, російська військова агресія в Україні, регіон, інтегральний узагальнюючий показник, компоненти людського капіталу.

**Introduction.** The latest Russian-Ukrainian war began in 2014 with the annexation of Crimea and the capture of parts of Luhansk and Donetsk regions. The new stage of this war began on February 24, 2022, with the full-scale invasion of Russian troops into Ukraine. Our neighbor broke into our house and destroys everything in his path. In the occupied territories, the occupiers rob and loot, abuse, rape and kill innocent people. The aggressor, with the help of aviation and artillery, levels everything to the ground, launches missile attacks on military and civilian objects inside the country far from the front line. Schools, hospitals and theaters, residential buildings and industrial premises are bombarded, the infrastructure is destroyed, not only military, but civilian objects are destroyed, and the most important thing is that in addition to the military, the civilian population – men, women, the elderly and children. In order to save their lives and avoid other troubles, the instinct of self-preservation prompts people to move within the country in the western direction, as well as to migrate abroad.

The consequence of this Russian armed aggression in Ukraine is not only the reduction of production and the outflow of labor force abroad, but also the reduction of opportunities for the formation and development of its human capital. Although the reconstruction of objects destroyed by the war requires skilled workers, financial resources, infrastructure, machinery, the latest technologies, etc. In order to eliminate the consequences of the war, restore the economy and strengthen the country's defense capabilities, first of all, a high level of development of its human capital is required. After all, human capital is closely related to economic growth. Increasing the knowledge and skills of employees increases their labor productivity, which positively affects the development and competitiveness of the economy of the regions and the country as a whole. "Human capital increasingly affects the level, pace of development and competitiveness of the region. It is also an important part of the knowledge-based economy. Its value and level directly affect innovation processes, as well as the processes of creation and transfer of knowledge and technologies" [1]. The confirmation of what has been said is, in particular, the study by scientists of the determining factors of growth at the regional level for 110 countries of the world, the economy of which accounts for 97% of the world GDP. The results of these studies showed that human capital is the most important factor because it explains a significant part of the regional dispersion [2]. Therefore, it is necessary to know how Russian military aggression affects the development of human capital in Ukraine, to be able to assess the level of this development in the regions of the country and to develop an effective policy for managing this development.

**Analysis of recent research and publications.** The idea of human capital can be seen even in the scientific works of the classics of economic theory: Petty V., Smith A., Ricardo D., Marx K. and others. The activation of scientific research on this issue took place in the 60s of the 20th century, when changes in production caused by scientific and technical progress required highly qualified workers. The consequence of these changes was a rethinking of the role of education, science, qualifications and complex labor in economic theory. Nobel laureates Schultz T. and Becker H. are considered the founders of the theory of human capital. These scientists, together

with their followers, substantiated the expediency of investing in a person [3; 4]. They proved that expenses for education and professional development of an individual, health care and raising children, finding a new place of work and other investments will return to her in the process of work. Problems related to the formation, development and realization of human potential or capital were considered in their research by a number of Ukrainian and foreign scientists and practitioners. Among the Ukrainian researchers who studied these problems, we can name such authors of scientific works as: Grishnova O. and Brintseva O. [5], Hrynkevich S. [6], Dolishnii M. and Zlupko S. [7], Kuzmin O. and Shakhno A. [8], Sadova U. and Stepura T. [9], Stefanyshyn O., Lysiak L. and Kachula S. [10], Semiv L., Kutsenko V., Libanova E., Petrova I., Shevchuk L. and others.

However, the studies of human capital by these and other scientists do not provide a complete picture of the trends in the development of this capital in the regions of Ukraine and the impact of Russian military aggression on this capital, which makes it necessary to carry out its diagnostics in recent years. This explains the relevance of the presented results of scientific research.

**Task statement.** The purpose of the article is to study the possibilities of assessing the level of development of human potential in the regions of Ukraine and to study the impact of Russian military aggression on this development.

**Presentation of the main research material.** It will be possible to restore the war-ravaged economy of Ukraine and move to its growth both intensively and extensively. Although there are no great hopes for an extensive way of its development, i.e. due to the quantitative increase of various resources. In the course of hostilities, the aggressor inevitably destroys all production reserves, including labor reserves. Therefore, there remains an intensive way of rebuilding the national economy.

The intensive development of the economy consists in improving production by improving the quality of various resources, in particular and mainly by increasing the level of development of human capital by improving its various characteristics. After all, "it is the person with his abilities that is the driving force of economic development. The economic and innovative development of both the region and the state as a whole depends on the development of human capital" [11]. The recovery of Ukraine's economy in the post-war period should be based on practically inexhaustible resources that form human capital, in particular on knowledge, intellectual and creative abilities of a person, etc. These resources are more important than natural resources or means of production. It is human capital, not plants, factories, machines, production stocks, that mainly ensures the efficiency of the economy and its growth.

Regarding the socio-economic category "human capital", there is no consensus among scientists regarding its interpretation. For example, it can be defined as a certain stock of health, knowledge, skills, abilities, motivations and other productive qualities formed or developed as a result of investments and accumulated by people, which is purposefully used in one or another sphere of economic activity, contributes to the growth of labor productivity and thanks to this affects the growth of its owner's income [12, p. 101]. The concept of "human capital" can be defined somewhat differently, but the main thing in its

understanding is that investments in human capital bring profit. The value created in the process of its operation is greater than the value of these investments.

**Algorithm of multidimensional comparative analysis of human capital of regions of Ukraine, which is used in the article.** One of the main problems that researchers face when assessing the level of human capital development in the region is the availability of the necessary primary information. The lack of certain financial and expert information on the level of human capital development in the regions of Ukraine prompted the use of the methods of multidimensional statistical analysis to assess this level of development, in particular, the method of constructing an integral generalizing indicator based on the annual values of partial statistical indicators. Russia's war against Ukraine has been going on since 2014. However, on February 24, 2022, a new phase of this war began. The hostilities spread throughout Ukraine.

To construct an integral indicator, annual values of all partial indicators used in the calculations are required, each of which in a certain way characterizes some aspect of human capital for the entire period under study. The lack of publicly available annual statistical data for 2021 and 2022 led to the need to build a general indicator of the level of human capital development in the region and calculate its values for the regions of Ukraine only for 2013–2020.

Let's consider in more detail the algorithm for building a complex integral indicator, the value of which will characterize the level of human capital development in the region. In this work, algorithms are generalized for the possibility of simultaneous comparison of human capitals of regions in both these dimensions.

Since partial primary indicators, the values of which we will use to construct an integral indicator, can have different dimensions, so at the beginning it is necessary to eliminate the influence of the dimension of each of them. That is, at the first stage of our algorithm, the values of partial primary indicators need to be reduced to dimensionless values. By assumption, they are all measured in the ratio scale, so all arithmetic operations can be performed on them.

Scientists offer different approaches to performing this procedure. Let's use the following formula for this:

$$z_{ij}^t = \left( \frac{x_{ij}^t}{\sigma_j} \right)^{l_j}, \quad (1)$$

where  $x_{ij}^t$  – the value of the  $j$ -th indicator ( $j = \overline{1, J}$ ) for the  $i$ -th region ( $i = \overline{1, I}$ ) or the  $t$ -th period of time ( $t = \overline{1, T}$ );  $z_{ij}^t$  – the dimensionless value of this indicator;  $l_j = 1$ , if the  $j$ -th indicator is a stimulant,  $l_j = -1$ , if the  $j$ -th indicator is a disincentive. Here  $x_j$ ,  $\sigma_j$  – respectively, the arithmetic mean and mean square deviation of the  $j$ -th indicator for all regions and for all time intervals. They are calculated using formulas:

$$\begin{aligned} \bar{x}_j &= \frac{\left( \sum_{i=1}^I \sum_{t=1}^T x_{ij}^t \right)}{(I \cdot T)}, \\ \sigma_j &= \left[ \frac{\left( \sum_{i=1}^I \sum_{t=1}^T (x_{ij}^t - \bar{x}_j)^2 \right)}{(I \cdot T)} \right]^{\frac{1}{2}}. \end{aligned} \quad (2)$$

Now, at the second stage of the considered algorithm, taking into account the possibility of summation of

dimensionless quantities, based on their values, we build the desired integral indicator according to a simple summation formula:

$$m_i^t = \sum_{j=1}^J z_{ij}^t \quad (i = \overline{1, I}, t = \overline{1, T}), \quad (3)$$

where  $m_i^t$  – the value of the complex integral indicator of the level of human capital development for the  $i$ -th region ( $i = \overline{1, I}$ ) for the  $t$ -th period of time ( $t = \overline{1, T}$ ).

Thus, by performing calculations according to formulas (1)-(3), we will obtain the desired values of the synthetic integral indicator for all studied regions of the country and all time periods for which annual statistical data are available.

**Description of the components of human capital and the used primary partial indicators.** As mentioned above, in order to solve the task and carry out calculations according to formulas (1)-(3), first of all, it is necessary to select a set of primary indicators that characterize the human capital of the region. A review of literary sources on this issue showed a lack of clarity in solving this problem. Scientists offer different sets of primary partial indicators to calculate one generalized integral indicator, the value of which would reflect the level of human capital development in a certain region. Thus, in the scientific article [13], investigating the peculiarities and trends of the development of human capital in Ukraine, the author considers 7 structural components of this potential: demographic (3 indicators), medical and biological (3 indicators), intellectual (5 indicators), educational (3 indicators), economic and motivational (6 indicators), cultural, social and psychological (4 indicators), as well as organizational (3 indicators). That is, a total of 27 partial indicators. In scientific papers [14–16], 26, 15, and 6 partial primary indicators were used, respectively, to assess the level of development or the quality of human capital of a country or region. Other authors offer their list of such indicators. So, even without considering these sets of primary indicators, but only considering the given numbers, it is clear that scientists do not have a single opinion on this issue.

Taking into account what has been said, we propose to consider the following structural components and partial primary diagnostic indicators of this capital in order to build an integral indicator of the level of human capital development in the region:

### I. Economic and demographic component

1. Labor force (until 2019 – economically active population) aged 15–70.
2. Natural population growth (decrease).
3. Migration growth (reduction) of the population.
4. Employed population aged 15–70.
5. Unemployment of the population aged 15–70 (according to the ILO methodology).

### II. Educational and scientific component

6. Number of children in pre-school institutions.
7. Number of students of general secondary education institutions.
8. Number of students in universities, academies, institutes (up to the 2016/17 academic year – higher educational institutions of III-IV levels of accreditation) at the beginning of the academic year.
9. The number of students in colleges, technical schools, schools (up to the 2016/17 academic year – higher

educational institutions of the I–II levels of accreditation) as of September of this year.

10. Number of graduates of professional (vocational and technical) education institutions.

11. The number of employees who improved their qualifications.

12. Number of researchers involved in scientific research and development.

13. Costs for carrying out scientific research and development.

14. Number of highly qualified specialists employed in the economy of the country (candidates and doctors of science).

### III. Medical and biological component

15. Number of doctors of all specialties.

16. Number of secondary medical personnel.

17. Number of hospital beds.

18. Capacity of outpatient clinical facilities (visits per shift).

19. Average life expectancy at birth.

20. Mortality rates of children under the age of 1 year.

21. The number of patients diagnosed with active tuberculosis for the first time in their lives.

### IV. Sociocultural component

22. Incomes of the population.

23. Average monthly nominal salary of full-time employees.

24. Housing stock (total area of residential premises).

25. Share of households that have access to Internet services at home.

26. Number of libraries.

27. Places in halls for showing films.

28. Number of detected crimes.

**Results of a comparative analysis of the level of human capital development in the regions of Ukraine for 2013–2020.** The procedure for quantitative assessment of the level of development of human capital in the regions of Ukraine requires the availability of statistical data of the above partial primary indicators that characterize this capital. The absence of generalized statistical information for the years 2021 and 2022 in open literary sources makes it impossible to perform a comparative analysis of the level of development of the HC in the regions of Ukraine using the above algorithm for these and other years. Therefore, in the work, we will perform a comparative analysis of the level of development of LK in the regions of Ukraine using the above-mentioned algorithm for constructing an integral indicator only for 2013–2020.

To perform calculations and build an integral indicator, it is desirable that the primary indicators selected for this purpose have a high level of variation, and the correlation coefficient for any two of them is small. In addition, it is necessary to take into account the availability of statistical data on the values of these partial primary indicators in the regional section. Taking into account the specified limitations, when performing calculations from this list of indicators, the following were removed from them: the number of employees who improved their qualifications; the number of highly qualified specialists employed in the country's economy (candidates and doctors of science); average life expectancy at birth; seats in movie theaters. As a result, the data of 24 primary indicators for 2013–2020 in annual terms or at the end of the corresponding year were used for calculations. When performing the calculations,

the values of the value indicators were adjusted taking into account inflation. Moreover, the calculations of the values of integral indicators were performed according to formulas (1) – (3) for the level of development of the HC and separately for each of its components, respectively, for each region of Ukraine (the temporarily occupied Autonomous Republic of Crimea did not participate in the calculations due to lack of data) and each year. The results of the calculations of this generalized indicator for the national human capital of Ukraine are presented in the table. 1. The peculiarity of the calculation algorithm used is that the comparison of the obtained values of the integral indicator can be performed not only in the columns or rows of this table, but simultaneously in the entire table, that is, simultaneously in two dimensions – by regions and years.

As it can be seen from this table, the impact of the Russian-Ukrainian war on the level of human capital development was insignificant in 2014 and more significantly in 2015. Compared to the previous year, the value of this indicator in 2014 increased significantly in the city of Kyiv, Poltava and Kharkiv regions and slightly in five other regions of Ukraine, and in 2015 it increased slightly only in Zakarpattia and Ivano-Frankivsk regions and decreased in all other regions of Ukraine. The regulatory policy of the state, which is aimed at improving the situation with human capital in the country, gave its results only in 2017. Compared to the previous year, the value of the investigated indicator decreased slightly this year only in the Mykolaiv, Poltava and Kherson regions.

Over the entire studied period, the highest level of development of HC took place in Kyiv, Dnipropetrovsk, Lviv, Odesa and Kharkiv regions, and the lowest – in Volyn, Kirovohrad, Kherson, Chernivtsi and Chernihiv regions. For obvious reasons, the value of the studied integral indicator from the largest among all regions of Ukraine for Donetsk and quite large for Luhansk in 2013 decreased in 2020 to the smallest. Therefore, we will bypass them in the further analysis.

The level of development of HC in 2020 compared to 2019 increased for most regions of Ukraine. The largest such growth occurred in Ivano-Frankivsk, Kirovohrad, Sumy, Ternopil, Kherson, Khmelnytskyi and Chernihiv regions. The decrease of this indicator for this year occurred only for the city of Kyiv, Dnipropetrovsk and Kharkiv regions.

The analysis of the results of the calculations showed that during the period from 2013 to 2020, the value of the indicator "level of development of HC" decreased for those regions in which it was the highest and increased for those in which it was the lowest. That is, the differentiation of the values of this general indicator for the regions of Ukraine during the studied period decreased.

As for the individual structural components of the region's human capital that we considered, the largest contribution to the value of the integral indicator of the level of development of this capital is made by the socio-cultural component, and the smallest by the economic and demographic component. That is, when developing a regional policy of managing the development of human capital, the greatest attention should be paid to the regulation of partial indicators of the socio-cultural component.

The performed calculations showed that for the period from 2013 to 2020, the value of the integral indicator, which reflects the level of development of

Table 1

**The value of the complex integral indicator of the level of human capital development  
in the regions of Ukraine for 2013–2020**

Name of the region	2013	2014	2015	2016	2017	2018	2019	2020
Vinnitsia	47,57	45,69	44,70	43,6	45,73	44,73	46,65	46,52
Volyn	34,75	35,77	34,25	34,83	45,46	36,49	36,79	38,03
Dnipropetrovsk	74,90	74,75	72,14	70,74	76,70	73,43	72,16	68,84
Donetsk	89,12	52,89	39,37	41,14	38,16	39,58	42,11	42,84
Zhytomyr	41,49	40,92	39,15	38,87	38,85	38,47	39,36	39,78
Zakarpattia	39,13	38,29	39,05	39,82	41,35	41,30	41,81	42,49
Zaporizhzhia	48,90	47,24	44,80	45,02	45,65	47,21	45,79	46,86
Ivano-Frankivsk	42,04	40,05	40,42	40,27	41,36	40,85	41,05	44,05
Kyiv	47,34	47,07	45,59	45,38	49,19	49,22	49,97	50,37
Kirovohrad	36,34	34,54	34,29	34,58	37,45	34,53	34,56	36,50
Luhansk	52,03	34,06	26,88	27,32	25,62	25,62	26,42	29,07
Lviv	64,09	64,31	62,13	62,11	63,65	61,12	60,25	60,31
Mykolayiv	39,74	38,57	36,16	37,75	37,27	38,32	37,79	39,08
Odesa	57,12	55,90	54,64	55,35	56,27	55,92	55,68	55,61
Poltava	42,61	44,09	41,39	40,76	39,82	41,46	42,20	43,96
Rivne	40,27	39,77	38,52	38,93	41,14	39,61	39,61	40,45
Sumy	37,41	37,41	36,57	35,96	37,38	35,92	37,12	40,57
Ternopil	39,09	39,37	38,62	36,67	40,39	38,66	39,00	41,64
Kharkiv	66,95	68,46	65,31	62,05	65,22	63,62	64,13	62,85
Kherson	37,06	36,17	35,09	36,73	34,89	35,95	34,74	38,81
Khmelnitsk	41,29	41,54	40,15	37,78	41,04	39,12	40,29	42,53
Cherkassy	39,78	40,52	38,16	39,04	39,25	39,83	39,70	40,51
Chernivtsi	35,99	35,41	35,12	36,48	38,33	37,98	36,31	37,19
Chernihiv	36,41	36,24	34,87	35,37	34,14	35,55	35,56	38,44
City of Kyiv	87,55	90,47	88,36	84,57	86,12	88,68	89,26	85,57

Source: calculated by the authors according to statistical data

the economic-demographic, educational-scientific, and medical-biological components, decreased in all regions of Ukraine, with the exception of: for the first component, Volyn and Kyiv regions, the second – Kyiv region and the city of Kyiv, the third – Volyn, Poltava, Sumy, Ternopil, Kharkiv, Kherson, Chernivtsi and Chernihiv regions. As for the integral indicator of the level of development of the socio-cultural component, its value increased for the specified period for all regions of Ukraine.

**Conclusions.** The conducted research showed that the Russian military aggression of 2014 had a significant negative impact on the development of human capital in the regions of Ukraine. The influence of the Russian-Ukrainian war on the level of human capital development

was slightly manifested in 2014 and more significantly in 2015. The regulatory policy of the state, which is aimed at improving the situation with human capital in the country, gave its results only in 2017. Compared to the previous year, the value of the studied indicator decreased slightly in only a few areas this year. The level of development of HC in 2020 compared to 2019 increased for most regions of Ukraine. During the period from 2013 to 2020, the value of the indicator "level of development of HC" decreased for those regions in which it was the highest and increased for those in which it was the lowest. That is, the differentiation of the values of this general indicator for the regions of Ukraine during the studied period decreased.

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