УДК 330.3; 331.1
https://doi.org/10.32342/3041-2153-2026-2-41-8

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Human Capital in the System of Innovative Modernization of Ukraine's Economy: A Socio-Economic Dimension

Citation: Osetskyi, V., Kuzmenko, T., Kulish, V., Hryhoruk, M. (2026). Human Capital in the System of Innovative Modernization of Ukraine's Economy: A Socio-Economic Dimension. *European Vector of Economic Development.* No. 2 (41). P. 103–118. https://doi.org/10.32342/3041-2153-2026-2-41-8

The article examines human capital within the system of innovative modernization of Ukraine's economy, taking into account economic and sociological approaches to defining its essence, structure, and functions. It traces the evolution of the human capital concept from the classical understanding of knowledge, education, professional skills, and health as economic resources to the contemporary understanding of digital human capital and the Human Capital 5.0 paradigm. The transformation of its key characteristics under the influence of digitalization, the growing use of artificial intelligence, and the transition to Industry 4.0 and Industry 5.0 models is analysed, highlighting the increasing importance of digital competencies, critical thinking, creativity, adaptability, and lifelong learning.

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The current state of human capital in Ukraine is examined in the context of the full-scale war, demographic crisis, migration, declining labour potential, structural imbalances in the labour market, and workforce shortages. Particular attention is given to adaptive capital as society's capacity to respond to crises, adjust its strategies, self-organize, and maintain institutional resilience. The dynamics of indicators and factors shaping adaptive human capital in Ukraine during 2024–2026 are analysed. The HCI+ penta-model of qualitative characteristics of new human capital is considered, encompassing innovativeness, adaptability, emotional intelligence, ethics of interaction with artificial intelligence, and spiritual and moral culture. Particular attention is also paid to veteran entrepreneurship as a mechanism for human capital circulation and for converting specific skills and experience acquired during military service into civilian economic activity.

Keywords: human capital, innovative modernization, Ukraine's economy, socio-economic dimension, Human Capital 5.0, adaptive capital, digital human capital, digital competencies, artificial intelligence, institutional resilience, veteran entrepreneurship

JEL classification*: J24, O10, O15, O31, O33*

У статті розглядається людський капітал у системі інноваційної модернізації економіки України з урахуванням економічних і соціологічних підходів до визначення його сутності, структури та функцій. Простежено еволюцію концепції людського капіталу: від класичного розуміння знань, освіти, професійних навичок і здоров'я як економічних ресурсів до сучасного трактування цифрового людського капіталу та парадигми «Людський капітал 5.0». Проаналізовано трансформацію ключових характеристик людського капіталу під впливом цифровізації, поширення штучного інтелекту та переходу до моделей «Індустрія 4.0» і «Індустрія 5.0», а також висвітлено зростаючу важливість цифрових компетентностей, критичного мислення, креативності, адаптивності та навчання впродовж життя.

Досліджено сучасний стан людського капіталу в Україні в умовах повномасштабної війни, демографічної кризи, міграції, зниження трудового потенціалу, структурних дисбалансів на ринку праці та дефіциту робочої сили. Особливу увагу приділено адаптивному капіталу як здатності суспільства реагувати на кризові явища, коригувати стратегії, самоорганізовуватися та зберігати інституційну стійкість. Проаналізовано динаміку показників і чинників, що формують адаптивний людський капітал в Україні протягом 2024–2026 рр. Розглянуто п'ятикомпонентну модель (HCI+) якісних характеристик нового людського капіталу, що охоплює інноваційність, адаптивність, емоційний інтелект, етику взаємодії зі штучним інтелектом, а також духовно-моральну культуру. Також окрему увагу приділено ветеранському підприємництву як механізму циркуляції людського капіталу та трансформації специфічних навичок і досвіду, набутих під час військової служби, у цивільну економічну діяльність.

Ключові слова: людський капітал, інноваційна модернізація, економіка України, соціально-економічний вимір, «Людський капітал 5.0», адаптивний капітал, цифровий людський капітал, цифрові компетентності, штучний інтелект, інституційна стійкість, ветеранське підприємництво

JEL classification*: J24, O10, O15, O31, O33*

Problem Statement

The transition from an industrial economy to a knowledge-based economy has transformed the role of human capital, the factors shaping its functioning, and scientific approaches to defining its specific characteristics. Human capital, as a determinant of national wealth, remains an important subject of academic research, international measurement, and comparative analysis. The current stage

of development is characterized by an ontological shift from viewing individuals solely as economic resources within the production process to recognizing them as active agents of digital transformation operating in an environment of hybrid intelligence, where human and artificial intelligence mutually reinforce each other.

The Ukrainian context adds particular relevance to this issue due to the impact of the war since 2014 and, especially, since the beginning of the full-scale invasion on 24 February 2022.

Understanding the complex nature of human capital requires an interdisciplinary approach that takes into account socio-economic factors and integrates insights from both economic and sociological perspectives.

The aim of the article is to analyse the concept, structure, types, functions, and evolution of human capital, as well as the specific features of its assessment in the context of the russian-Ukrainian war and from the perspective of Ukraine's innovative modernization and economic development.

Literature Review

An analysis of the concept and essential characteristics of human capital indicates that there is no single, universally accepted definition of this category. A. Smith laid the conceptual foundations for human capital in his seminal work 'An Inquiry into the Nature and Causes of the Wealth of Nations' (1776), although he did not use the term itself [1]. According to T. Schultz (1961), one of the founders of the modern human capital concept, human capital comprises "useful skills and knowledge... Human capital is an integral part of the person who possesses it and serves as a source of future income and productivity growth" [2].

Acquired knowledge, skills, abilities, motivation, and health become an individual's capital when they can be converted into a resource that generates future income from the production of goods and services [1].

Nobel laureate G. Becker, in 'Human Capital: A Theoretical and Empirical Analysis', defines human capital as the stock of knowledge, health, skills, and experience that individuals use to generate income. Becker distinguished between two types of investment in human capital: general investment, which workers primarily make in education and general training and which can be applied across different enterprises; and specific investment, which involves competencies acquired directly in the workplace while performing job-related functions [1].

The economic approach to human capital developed by G. Becker and T. Schultz views education, skills, and health as resources in which investment can generate returns. From this perspective, homo economicus is regarded as a rational actor and human capital as a measurable asset. The primary focus is therefore on quantitative indicators, including expenditure on education and healthcare, the contribution of skilled labour to GDP, and other measurable indicators [3].

The sociological approach, by contrast, is based on the model of homo sociologicus, whose behaviour is shaped by the institutional environment, value and normative systems, and position within the social structure. P. Bourdieu distinguishes cultural capital and social capital, the latter encompassing social networks and relationships. In the modern economy, substantial capital growth is driven not by physical capital alone, but increasingly by human capital. Human capital itself, including high-quality education, qualifications, skills, professional status, and physical condition, does not operate in isolation. Its capitalization depends on the

broader social context, including social networks, trust in social institutions and actors, family support, patterns of social inequality, and the institutional environment. These factors determine whether a social actor can successfully capitalize on their knowledge and improve their position within the social field [4].

J. Coleman argued that parental supervision and support, involvement in the local community, and "network closure" create educational and career opportunities for young people, enhance the quality and resilience of human capital, and contribute to the reproduction of social structures and social inequality [5].

R. Putnam's collectivist approach likewise emphasizes the role of social capital in shaping human capital. A high level of trust within a community and active involvement in community life improve coordination, communication, and mutual understanding, enhance competencies, facilitate innovative and economic development, and contribute to the creation of collective goods, thereby providing a foundation for democracy and civil society [6].

Social trust as a social factor is becoming increasingly important, serving as a critical "lubricant" and "glue" within systems of social interaction, as described by P. Sztompka (2020). In low-trust societies, the capitalization of human capital is constrained by high costs associated with control, security, and bureaucracy, making economic efficiency dependent on social factors [7].

The specific features of the economic and sociological approaches to analysing the concept of human capital are presented in Table 1.

Table 1

Economic and Sociological Approaches to the Analysis of Human Capital*

Criterion	Economic Approach	Sociological Approach
Driving Force of the Individual	The individual is rational and oriented towards maximizing utility and profit (*homo economicus*).	The individual is a social actor whose behaviour is shaped by values, norms, and social networks (*homo sociologicus*).
Research Methods	Quantitative methods (econometrics, mathematical modelling).	Qualitative and quantitative methods (interviews, sociometry, network analysis, monitoring studies).
Main Focus	Maximization of utility and profit. Market value of skills, wages, GDP; relationship between years of formal education, work experience, and wage levels.	Social mobility, reproduction of inequality, quality of life, trust, and agency.
Core of the Concept	Investment in education, skills, health, and productivity.	Social networks, trust, cultural norms, and social capital.
Main Function	Growth in income and GDP.	Ensuring social cohesion, social status, and societal resilience.
Representatives	A. Smith, T. Schultz, G. Becker, J. Mincer, P. Romer, R. Lucas.	P. Bourdieu, J. Coleman, R. Putnam, P. Sztompka, N. Lin.

**Source: compiled by the authors based on [7; 8]*

Ukraine's contemporary innovative modernization requires the integration of these approaches, as economic returns cannot be achieved without a high level of social trust.

Contemporary human capital research is increasingly grounded in an interdisciplinary approach, bringing together behavioural economics and institutional sociology, as well as the sociology of work, the sociology of personality, and related fields [8].

To better understand the specific features of the contemporary approach, it is useful to characterize and summarize the key stages in the evolution of the concept of human capital (Table 2).

Table 2

Stages in the Evolution of the Concept of Human Capital*

No.	Stage	Essential Characteristics
1	Genesis and Classical Political Economy (18th century–mid-20th century)	W. Petty, A. Smith, and D. Ricardo. Assessment of the "value of a person" and expenditure on education as investment. The worker is viewed as a supplementary factor in the production process.
2	Neoclassical Breakthrough of the Chicago School (1950s–1970s)	T. Schultz, G. Becker, and J. Mincer. Microeconomic theory and the mathematization of returns to education; the distinction between general and specific human capital; evidence that investment in human capital yields higher returns than investment in physical assets.
3	Post-Industrial Stage and the Knowledge Economy (late 20th–early 21st century)	Focus on intangible assets, knowledge, intellectual property, and creativity. The network society (M. Castells). Knowledge becomes global.
4	Digital Stage (since the 2010s: Industry 4.0 and Industry 5.0)	The emergence of the new concept of digital human capital. Cognitive competencies, soft skills and meta-skills, and the ability to effectively use AI.

**Source: compiled by the authors based on [8; 9; 10]*

The analysis of the genesis of human capital makes it possible to identify the fundamental characteristics of the post-industrial stage of its evolution:

- The "knowledge economy" paradigm (M. Castells, P. Himanen, J. Rifkin): Material production dominated by routine labour is increasingly displaced by the information and knowledge-intensive sector. Knowledge and creativity are recognized as the primary sources of national wealth creation [8].
- Endogenous growth models (P. Romer and R. Lucas): The expansion of human capital generates continuous innovation and ensures sustainable economic growth at the macroeconomic level [11].
- Structure of national wealth (according to the World Bank and UNDP model): Human capital accounts for a growing and predominant share of national wealth in post-industrial societies (70–80%), while physical assets account for approximately 16% [10, p. 22].
- The concept of open innovation (H. Chesbrough): At the post-industrial stage, human capital operates through network-based interaction between science and business [10, p. 24].

Main Research Findings

At the beginning of the 21st century, the modern concept of human capital underwent further profound ontological transformations (Table 3), driven by the transition to the digital models of **Industry 4.0 and Industry 5.0**. I. Zhuravlova (2025) describes this transformation through a comparison of the essential characteristics of human capital.

Table 3

Transformation of Human Capital: Traditional and Digital Dimensions*

Comparison Criterion	Traditional Human Capital (20th century)	Digital Human Capital (21st century)
Essential Characteristics	Formal education, a lifelong specialization, professional experience, and hard skills.	Digital literacy, data literacy, and AI competencies (interaction with AI).
Key Competencies	Narrow specialization, work discipline, and the performance of standard and routine tasks.	Critical thinking, media literacy, soft skills and meta-skills, emotional intelligence, hybrid intelligence, and employee agency
Sources of Human Capital Formation	Formal educational institutions (general secondary schools, vocational education and training institutions, higher education institutions).	Lifelong learning, EdTech, self-directed learning, micro-credential programmes, and dual education
Skills Life Cycle	10–15 years.	2–5 years (due to the rapid obsolescence of technologies).
Validation Mechanism	Educational and professional qualification diplomas, employment record, and length of service.	Digital badges, certification, HR analytics tools, and a dynamic portfolio.
Work Location	Mandatory physical presence of the employee at the workplace.	Remote work, cloud-based offices, and high spatial mobility.

Source: compiled by the authorts based on [8]

The Fourth Industrial Revolution laid the foundation for digital capital (N. Ivanova, I. Zhuravlova, 2025), based on digital competencies and the ability to effectively use the digital ecosystem. In the context of the full-scale war, demographic crisis, and infrastructure destruction, Ukraine faces severe challenges and critical pressures in the labour market [12–13].

The current state of human capital is characterized by irreversible losses that pose threats to socio-economic resilience and the innovative modernization of Ukraine's economy:

• *Decomposition of labour potential*. Mobilization, external migration, and internal migration have significantly affected employment in the economy. According to the *KSE Institute (2026)*, the number of taxpayers in Ukraine has declined significantly, falling by 1.3 million in 2025 compared with 2021. The number of formally employed persons decreased to 10.7 million, approaching the number of pensioners (10.2 million). This places a substantial burden on the solidarity-based social security system and the public sector [13].

• *Structural unemployment and workforce shortages*. A paradoxical situation has emerged: relatively high unemployment, which reached 20.6% in

2022 and subsequently stabilized at approximately 10–11% in 2025, coexists with a substantial increase in labour demand. According to sociological survey data, 74% of employers experienced labour shortages in 2024, while only 7% did not require additional staff. Employers indicate that the key challenge is a structural mismatch: job applicants largely fail to meet labour market requirements in terms of competencies, qualifications, and/or place of residence [13].

• *Veteran reintegration crisis*. More than 81% of veterans assessed the likelihood of experiencing employment difficulties after returning from the frontline as "very likely" or "rather likely." More than 50% of former military personnel are dissatisfied with their current level of education and qualifications, which may subsequently create employment difficulties [14]. This challenge is compounded by a global trend: according to the OECD, more than 60% of jobs in developed countries require basic or advanced digital skills, while demand for these competencies is expected to increase by 25–30% by 2030. In Ukraine, according to the State Employment Service, more than 40% of vacancies required digital literacy as of 2023, twice the level recorded in 2015 [15]. Digital literacy is thus becoming one of the basic competencies required in the labour market.

Therefore, qualitative changes in human capital may compensate for the quantitative losses experienced by Ukraine. In extreme crisis situations, particularly under conditions of full-scale war, the concept of human capital undergoes a qualitative shift in which adaptive capital (E. Libanova, 2025) comes to the forefront. It refers to the collective capacity to rapidly change strategies, adapt, and respond to wartime conditions.

As N. Ivanova (2025) notes, manifestations of self-organization, innovativeness, and the capacity to adapt during crises indicate the emergence of a new and vital type of human capital, namely adaptive capital. The latter represents society's collective capacity to independently solve problems and respond flexibly to challenges [16–17; 8].

These qualitative shifts are leading the Ukrainian economic system towards incorporating the parameters of the new economic paradigm of Human Capital 5.0, whose intellectual core lies in society's capacity to create, reproduce, and apply knowledge through cognitive skills, research capabilities, creativity, entrepreneurial thinking, and technological adaptability [18, p. 5]. This is combined with human-centricity in the application of technology [19, p. 194] and a focus on dignity and respect, including consideration of human values and rights [12].

Human capital in the 21st century reflects the transition from Industry 4.0, characterized by extensive automation, to Industry 5.0, which places people back at the centre of production processes. In the context of full-scale war, adaptive human capital reflects Ukrainian society's capacity to respond rapidly to challenges, change, self-organize, and remain resilient in extreme crisis situations. Its key manifestations include:

• *Effective social capital ("glue")*. Volunteer networks supported the state in performing important functions during the most critical period at the beginning of the war, enabling social solidarity to be transformed into material and logistical resources. Volunteers continue to enjoy a consistently high level of public trust.

• *Labour market flexibility*. Rapid reskilling in response to the needs of the labour market and the defence-industrial complex represents a form of horizontal

mobility. For example, a manager may become a paramedic or UAV operator, while an entrepreneur may reorient a business towards defence production.

• *Institutional resilience*. This refers to the capacity of institutions, including schools, higher education institutions, and hospitals, to continue functioning despite extensive physical destruction of infrastructure and shortages of human resources. This capacity is supported primarily by employees' commitment and their ability to adapt [16; 20–22].

According to the Info Sapiens analytical report, the perception of volunteer networks as an unquestionably effective social institution declined from 47% in 2024 to 39% in 2026. In 2026, the majority of Ukrainians (53%) remained willing to endure the hardships caused by the war for as long as necessary to achieve victory; however, this represents a 16% decrease compared with 2024. The lowest share of those willing to endure wartime hardships and the highest share of those unwilling to do so were recorded among Ukrainians aged 30–39 [22].

In 2026, confidence in the Armed Forces of Ukraine remained the main source of resilience for Ukrainians at 57%, compared with 63% in 2025 and 64% in 2024, although this indicator declined considerably over the period. The role of personal involvement in volunteering and fundraising as a factor supporting psychological resilience also decreased twofold, from 18% to 9% [22, pp. 10–15].

The economic mechanisms of adaptive capital have become increasingly complex. Spontaneous crowdfunding has evolved into high-tech volunteer clusters involved in the production of electronic warfare systems, UAVs, and software, partially compensating for shortages and imbalances within the defence-industrial complex. The integration of employers and the development of network-based resilience formats within Human Capital 5.0 are guided by international EBRD documents and UNDP strategic frameworks [13].

Technological solutions are increasingly compensating for workforce shortages. In the context of the loss of 1.3 million taxpayers, the widespread implementation of hybrid digital HRM models and AI tools has become an instrument for maintaining the functionality of key systems, including healthcare, education, and taxation, confirming the transition towards Human Capital 5.0 [8; 15].

Classical quantitative indicators, such as years of formal education, length of service, and narrowly specialized employee competencies, do not provide an adequate basis for assessing and forecasting the functioning of an economic system under crisis conditions. When physical infrastructure is destroyed and traditional sources of support are depleted, the actual antifragility of the system increasingly depends on intangible internal characteristics of individuals [15].

This necessitates a new approach to human capital analysis that enables the assessment of cognitive, ethical, and cultural parameters within the Human Capital 5.0 paradigm. The penta-model of qualitative characteristics of new human capital (HCI+) enables a comprehensive assessment of the innovativeness, adaptability, and spiritual and moral culture of actors involved in the modernization of Ukraine's economy.

The components and characteristics of the HCI+ penta-model are as follows:

1. Innovativeness (Creative Thinking). Creativity becomes a key factor in creating added value under conditions of resource and financial constraints, particularly in the defence-industrial complex and in non-standard defence

and logistics projects. This also includes the ability to use AI and big data for professional decision-making in crisis situations.

2. Adaptability (Flexibility to Change). Adaptability refers to the ability of individual and collective actors to respond rapidly to challenges and change their strategies under extreme crisis conditions. Lifelong learning is essential for maintaining qualifications in a rapidly changing environment, particularly during wartime. The implementation of adaptive management models and the restructuring of HR processes help ensure flexibility during the war and minimize losses of workforce potential.

3. Emotional Intelligence (Empathy and Leadership). Empathy forms the basis of social solidarity, transforming personal emotional distress into a tangible motivational resource. The majority of Ukrainian citizens are involved in supporting the Armed Forces and people affected by the war. Decentralized, human-centric leadership contributes to institutional survival and inclusive integration, including that of veterans, internally displaced persons, and persons with disabilities.

4. Ethics of Interaction with AI. A new requirement of Human Capital 5.0 is the ability to interact effectively with AI while complementing it with distinctly human qualities, including morality, creativity, critical thinking, social cohesion, and ethical responsibility.

5. Spiritual and Moral Culture (Responsibility). An innovative economy cannot function without cultural capital and spiritual culture. Moral maturity, responsibility for the future, and the alignment of individual goals with national priorities are therefore important characteristics of new human capital.

Within the Human Capital 5.0 concept, there is a growing need to transition towards active and innovative institutional models. Veteran entrepreneurship is considered one of the effective mechanisms for the reintegration and circulation of human capital. The involvement of veterans is regarded in academic discourse as a distinctive macroeconomic process of regenerating national wealth, requiring a reconsideration of the role of demobilized military personnel in the labour market.

In contemporary economic discourse, veteran entrepreneurship is viewed not only as a form of self-employment or social adaptation, but also as a mechanism for the circulation of human capital, enabling the transition from military experience to civilian economic activity and contributing to added value creation, employment, entrepreneurial activity, and the sustainable development of local communities [23; 24].

Within the concept of the acquisition and circulation of specific skills (meta-skills), military service enables individuals to develop specific capabilities, including decision-making under critical conditions and time constraints, high self-efficacy, strategic resource planning, stress resilience, and willingness to take risks. These capabilities can subsequently be converted into productive competencies in civilian economic activity.

The number of veterans increased from 739,000 in 2021 to 1.7 million in 2025 [13] and is expected to continue growing.

The results of sociological studies conducted by DCAF and the NGO "Horyzont Zmin" indicate that veterans seek to become active agents of economic and social change rather than passive recipients of benefits and assistance. Most veterans are between 25 and 44 years old, an age associated with active professional and

career development, while more than 50% of respondents have higher education. Veterans demonstrate readiness for reskilling, self-employment, and mentoring, as well as demand for establishing their own business ventures. Within the Human Capital 5.0 framework, these findings illustrate a transition towards building an adaptive and inclusive environment while preserving the potential of Ukraine's defenders [25]. Successful examples of self-employment include both traditional activities, such as farming, woodworking, and food services, and innovative areas, including shrimp farming, agricultural drones, pest-control services, dance studios, and barbershops [25, p. 79].

The structure and mechanisms of veteran entrepreneurship within the Human Capital 5.0 system are presented in Table 4.

Table 4

Structure and Mechanisms of Veteran Entrepreneurship within the Human Capital 5.0 System*

Component of the Systemic Effect	Mechanism and Manifestation within the Human Capital 5.0 Concept	Socio-Economic and Institutional Outcome
Transformation of Post-Traumatic Experience into Growth (Post-Traumatic Growth)	Starting one's own business serves as a powerful instrument for socio-psychological adaptation and self-realization. A pronounced "sense of life purpose" is associated with a 1.25-fold higher propensity for entrepreneurial activity.	Preservation of a high level of individual agency, rejection of paternalistic models, and restoration of a sense of control over one's own life trajectory.
Generation of Social Value (Stakeholder Value)	Veteran-owned businesses operate within decentralized "networks of trust" at the level of local communities. They prioritize the employment of fellow veterans, support the families of fallen service members, and sponsor local initiatives.	Implementation of Vector 5 of the HCI+ penta-model (Spiritual and Moral Culture): ethical awareness, transparency, and high levels of public trust contribute to minimizing corruption risks.
Regional Business Incubation	Implementation of the State Target Programme for the Support of Veteran Entrepreneurship for 2026–2028. Alignment of community needs assessments with preferential microcredit and grant programmes.	Revitalization and stimulation of frontline areas, partially offsetting the destruction of large industrial facilities through the development of flexible SMEs.

Source: compiled by the authors based on [26–29]

The military experience of veterans is transformed into an asset for development. Entrepreneurship creates opportunities for post-traumatic growth and enables veterans to become active agents of Human Capital 5.0, contributing to self-recovery, resilience, and the development of their country. Veteran-owned businesses generate not only economic capital but also social and ethical capital within decentralized community "networks of trust."

Government and international support contribute to the resilience of veteran microenterprises in economically depressed and frontline regions, where they perform the function of regional business incubators.

Conclusions

The study demonstrates the transformation of human capital from the traditional understanding of knowledge, education, professional skills, and health as economic resources towards a broader model encompassing digital competencies, critical thinking, creativity, adaptability, emotional intelligence, and the capacity for lifelong learning. The transition to Industry 4.0 and Industry 5.0 increases the importance of digital human capital and a human-centric approach to technological development.

Under conditions of full-scale war, Ukraine's human capital is experiencing substantial quantitative and structural losses associated with the demographic crisis, migration, declining labour potential, workforce shortages, and the structural mismatch between competencies and labour market needs. Under these conditions, adaptive capital becomes particularly important as society's capacity to respond flexibly to crisis-related challenges, self-organize, and maintain institutional resilience. The analysis of trends during 2024–2026 also indicates a transition from spontaneous social mobilization towards the pragmatic maintenance of societal viability against a background of increasing fatigue and exhaustion.

Traditional quantitative characteristics of human capital do not fully capture its functioning under crisis conditions. Within the Human Capital 5.0 paradigm, greater importance is attached to the qualitative characteristics reflected in the HCI+ penta-model: innovativeness, adaptability, emotional intelligence, ethics of interaction with artificial intelligence, and spiritual and moral culture. Their combination reflects a transition towards a model of human capital in which technological adaptability is complemented by human-centricity and social resilience.

Veteran entrepreneurship is identified as an important mechanism for human capital circulation, creating opportunities to convert specific skills and experience acquired during military service into civilian economic activity, employment, and added value creation. Thus, the qualitative transformation of human capital, its adaptability, innovativeness, and capacity to interact effectively with technology are becoming particularly important for the innovative modernization and economic development of Ukraine.

Declaration on the Use of Artificial Intelligence*. The authors used Microsoft Copilot 2.20261001.61.0 to assist with the English translation and grammar of the manuscript. The tool was not used to generate research results, data or conclusions. The text was reviewed and edited by the authors, who take full responsibility for the content and confirm that no AI tool meets the criteria for authorship.*

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Human Capital in the System of Innovative Modernization of Ukraine's Economy: A Socio-Economic Dimension

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https://doi.org/10.32342/3041-2153-2026-2-41-8

Keywords: human capital, innovative modernization, Ukraine's economy, socio-economic dimension, Human Capital 5.0, adaptive capital, digital human capital, digital competencies, artificial intelligence, institutional resilience, veteran entrepreneurship

JEL classification*: J24, O10, O15, O31, O33*

The article examines human capital within the system of innovative modernization of Ukraine's economy, taking into account economic and sociological approaches to defining its essence, structure, and functions. It traces the evolution of the human capital concept from the classical understanding of knowledge, education, professional skills, and health as economic resources to the contemporary understanding of digital human capital and the Human Capital 5.0 paradigm. The transformation of its key characteristics under the influence of digitalization, the growing use of artificial intelligence, and the transition to Industry 4.0 and Industry 5.0 models is analysed, highlighting the increasing importance of digital competencies, critical thinking, creativity, adaptability, and lifelong learning.

The current state of human capital in Ukraine is examined in the context of the full-scale war, demographic crisis, migration, declining labour potential, structural imbalances in the labour market, and workforce shortages. Particular attention is given to adaptive capital as society's capacity to respond to crises, adjust its strategies, self-organize, and maintain institutional resilience. The dynamics of indicators and factors shaping adaptive human capital in Ukraine during 2024–2026 are analysed. The HCI+ penta-model of qualitative characteristics of new human capital is considered, encompassing innovativeness, adaptability, emotional

intelligence, ethics of interaction with artificial intelligence, and spiritual and moral culture. Particular attention is also paid to veteran entrepreneurship as a mechanism for human capital circulation and for converting specific skills and experience acquired during military service into civilian economic activity.

Дата надходження до редакції / Submitted: 09.08.26
Дата прийняття до публікації / Accepted: 15.09.26
Дата публікації / Published: 10.11.26