Міністерство освіти і науки України
Державний біотехнологічний університет

ГЛОБАЛЬНІ ЕКОНОМІЧНІ ТРАНСФОРМАЦІЇ ТА ЦИФРОВІ ІННОВАЦІЇ В БІЗНЕСІ

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Human Capital in the System of Digital Transformation Drivers

Under the contemporary conditions of the emergence of the digital economy and the transition to the Industry 5.0 paradigm, particular importance is attached to the study of the relationship between artificial intelligence, digital transformation, and human capital as key drivers of economic development. The interaction among labor productivity, digital transformation (DT), digital human capital (DHC), and the context of artificial intelligence (AI) development forms the systemic foundation of the modern competitiveness of the national economy.

The proposed conceptual framework reflects a multi-level system of cause-and-effect relationships within which the preconditions for labor productivity growth and the enhancement of national competitiveness are formed.

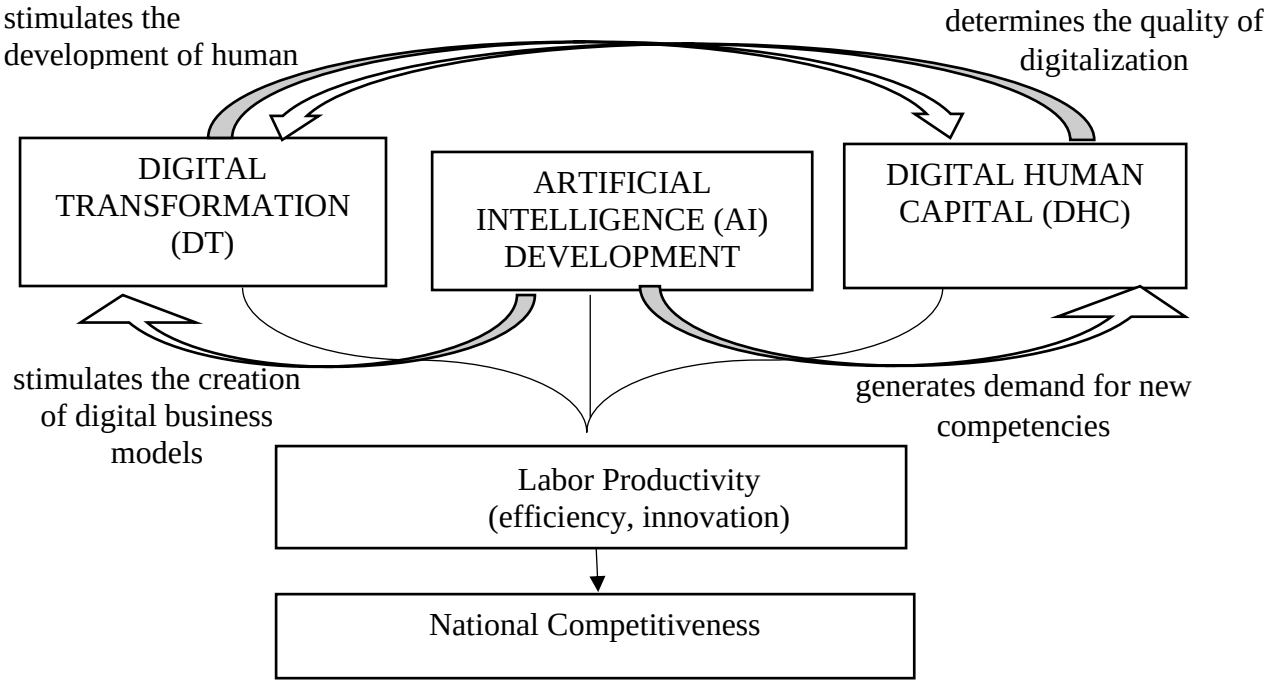

Figure 1. Conceptual Framework of the Relationship between Digital Transformation, Digital Human Capital, and Artificial Intelligence
Developed by the author

Digital transformation acts as a catalyst for structural change by enabling the implementation of innovative technologies, process automation, and improved resource efficiency. At the same time, its effectiveness largely depends on the level of

development of digital human capital, which encompasses a set of digital competencies, analytical capabilities, and the ability for lifelong learning. It is digital human capital that determines the ability of an economy not only to adapt to technological changes but also to generate its own innovations.

The context of artificial intelligence development at the national level performs the role of an institutional and technological environment that strengthens the interaction between digital transformation (DT) and digital human capital (DHC). A developed AI ecosystem (including infrastructure, regulatory framework, investments, and research potential) facilitates the scaling of digital solutions, improves the quality of managerial decision-making, and optimizes production and service processes. Collectively, these elements directly affect labor productivity, which serves as an integral indicator of the efficiency of economic performance. Productivity growth is achieved through the synergy of technological innovation, human capital, and institutional conditions that ensure their coordinated development [1].

A significant characteristic of the proposed framework is its cyclical, or ecosystem-based, nature. The growth of competitiveness creates additional resources for investment in the development of artificial intelligence, digital infrastructure, and human capital, which, in turn, further reinforces the processes of digital transformation. Thus, the system functions as a closed-loop cycle with positive feedback, in which each element not only depends on the others but also influences their further development.

The empirical verification of the proposed model is based on contemporary statistical data on digital skills, human capital, and labor productivity, which makes it possible to substantiate the relevance of the relationships under study. The European Union has set a target according to which at least 80% of the EU population should possess at least basic digital skills by 2030. In 2025, 60% of EU citizens aged 16 to 74 had at least basic digital skills, representing an increase compared to 54% and 56% in 2021 and 2023, respectively. Significant differences were observed across socio-demographic characteristics, such as age and level of education [2]. An analysis of cross-country differences demonstrates significant unevenness in digital development. In particular, the highest indicators were recorded in the Netherlands (83%) and Finland (82%), while in Romania this figure amounts to only 28%. Such differentiation confirms the existence of structural imbalances in the development of digital human capital across Europe [3].

Particularly important is the relationship between the level of education and digital skills. According to Eurostat data, among individuals with a high level of education, the share of those possessing basic digital skills reaches 80%, whereas among individuals with a low level of education it is only 34%. This empirically confirms the hypothesis regarding the key role of digital human capital (DHC) in the processes of digital transformation [2].

Additionally, it should be noted that the share of employment in the ICT sector within the EU accounts for approximately 5% of total employment (more than 10 million people), and this indicator has demonstrated steady growth over the past decade. This indicates structural changes in the labor market and the increasing role of digital competencies as a factor of economic productivity [3]. From the perspective of international comparison, OECD studies confirm that around 25% of the adult

population in OECD countries do not possess even basic digital skills, which significantly limits their participation in the digital economy. At the same time, the combination of digital and cognitive skills substantially increases labor productivity and adaptability to technological change [4]. At the same time, despite active digitalization, European countries are experiencing the problem of slowing labor productivity growth. Productivity in the euro area demonstrates weak growth dynamics, highlighting the need to improve the efficiency of digital technology utilization and human capital development.

The presented statistics confirm the key assumptions that there is a significant gap in digital skills between countries and social groups; the level of education directly correlates with the level of digital competencies; digital human capital acts as a critical factor in the effectiveness of digital transformation; and the insufficient development of skills limits the impact of digitalization on productivity.

Empirical data confirm that the interdependence of DT, DHC, and the AI context creates a multiplicative effect that enhances labor productivity and determines the long-term competitiveness of a country. Countries that ensure the balanced development of these components gain sustainable competitive advantages in the global economy, whereas disproportionality among them may constrain innovation potential and economic growth.

The proposed comprehensive approach to assessing the role of digital human capital in shaping a country's competitive advantages, unlike existing approaches, takes into account the synergistic impact of artificial intelligence development and digital transformation on labor productivity and ensures a comprehensive consideration of the interdependencies among educational, technological, and institutional factors.

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