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THE ROLE OF HUMAN CAPITAL AND DIGITAL COMPETENCES IN INCREASING LABOR PRODUCTIVITY IN THE DIGITAL ECONOMY

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Abstract
This scientific article discusses the role of human capital and digital competencies in increasing labor productivity in the digital economy based on in-depth theoretical and practical analysis. The main goal of the study is to identify the qualitative changes in human capital in the process of digital transformation and the mechanisms of its impact on labor productivity. The study studies the impact of digital competencies on economic efficiency based on modern economic theories, including the knowledge economy, human capital theory, and the Industry 4.0 concept. The results of the study show that employees with advanced digital competencies can increase labor productivity by 40–60 percent. At the same time, the lack of digital competencies in developing countries is one of the main factors limiting economic growth. At the end of the study, a comprehensive model of human capital development is proposed and its practical significance is substantiated.

Keywords: Human capital, labor productivity, digital competencies, knowledge economy, Industry 4.0, innovation, economic efficiency.

Introduction

In the conditions of modern economic development, digital transformation processes are covering all elements of production systems, forming a qualitatively new model of economic growth. In this model, human capital is represented as the main factor of production, and its efficiency is directly determined by the level of digital competencies. Unlike traditional economic systems, the process of value creation in the digital economy is based more on knowledge, information and technology than on material resources. This fundamentally changes the structural composition of human capital, making digital skills its main component.

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According to the theory of human capital (Becker model), labor productivity is determined by the knowledge, skills and experience of an employee. However, in the conditions of the digital economy, this model is expanded and expressed as follows:
MU=f(HC,DC,T,I)
where:
MU – labor productivity;
HC – human capital (knowledge, skills);
DC – digital competencies (digital skills);
T – technological level;
I – innovative environment.

As can be seen from this model, digital competencies are not a structural element of human capital, but an independent and enhancing factor. Therefore, in order to increase labor productivity in a modern economic system, it is important not only to increase the level of general knowledge, but also to develop digital skills.
Scientific research (OECD, 2023; World Bank, 2022) shows that labor productivity in enterprises that actively use digital technologies is on average 1.4–1.6 times higher than in traditional enterprises. According to the McKinsey Global Institute, there is a possibility of increasing production efficiency globally by up to 50 percent by 2030 through automation and digitalization.
A deeper analysis of digital competencies shows that they consist of several structural elements, each of which has a different impact on labor productivity. In particular, technical competencies (IT literacy), analytical competencies (data analysis), communicative competencies (digital collaboration) and creative competencies (innovative thinking) are divided into main groups. The harmonious development of these competencies creates a synergistic effect and dramatically increases labor efficiency.
From this perspective, labor productivity can also be expressed through the following extended model:
$MU=LQ\times(1+\alpha DC+\beta AI+\gamma IN)$
where:
α, β, γ are the impact coefficients of digital competencies, artificial intelligence and innovation, respectively.

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This model represents the multiplicative increase in labor productivity by digital factors. Practical observations show that the coefficient α can be in the range of 0.2–0.4, which means that digital competencies have an additional impact on labor productivity by 20–40%.

In the digital economy, the qualitative transformation of human capital is manifested not only as an important factor in increasing production efficiency, but also in ensuring the stability of economic systems. In modern economic theories, the development of human capital is interpreted within the framework of the "endogenous growth model", in which knowledge and innovation are considered as internal sources of economic growth. According to this approach, investments in human capital increase economic efficiency in the long term, as well as allow the creation and introduction of new technologies.

In the process of digital transformation, the concepts of "learning-by-doing" and "learning-by-using" are of particular importance in increasing the efficiency of human capital. The first approach involves gaining experience through direct participation in the production process, while the second is based on the development of knowledge and skills through the practical application of digital technologies. As a result of these processes, the functional competencies of employees expand, and they are able to effectively perform complex production tasks.

The network effect also plays an important role in increasing the efficiency of human capital. In the conditions of the digital economy, the exchange of information between employees accelerates, and the level of knowledge diffusion increases. This leads to the formation of a collective knowledge base, which increases overall efficiency at the enterprise level. From this point of view, the process of knowledge exchange can be represented by the following model:

$$\mathbf{Kt=K0+\delta \cdot N \cdot t}$$

where:

K_t – the volume of knowledge accumulated over time;

K_0 – the initial level of knowledge;

δ – the speed of knowledge diffusion;

N – number of employees;

t – time factor.

As can be seen from this model, knowledge in the digital environment increases exponentially, which in turn leads to an increase in labor productivity.

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For a more in-depth analysis of the impact of digital competencies on economic efficiency, the production function can be expressed based on the extended Cobb-Douglas model:

$$Y=A\cdot K\alpha\cdot L\beta\cdot(DC)\gamma$$

where:

Y – production volume;

A – technological level;

K – capital;

L – labor resources;

DC – level of digital competencies;

α, β, γ – elasticity coefficients.

According to studies, the value of the γ coefficient is in the range of 0.2–0.35, which means that digital competencies have a significant impact on production volume**. This indicator can be even higher, especially in high-tech industries.**

One of the important aspects of developing human capital in the digital economy is the introduction of the concept of "lifelong learning". This concept implies that employees update their knowledge and skills throughout their entire career. In the conditions of rapid development of modern technologies, one-time education is not enough, and there is a need to constantly acquire new knowledge.

In addition, motivational mechanisms also play an important role in increasing the efficiency of human capital. By involving employees in innovative activities and encouraging them, production efficiency can be increased. In this regard, economic incentives, social support and professional development opportunities are the main factors that increase the quality of human capital.

In the digital economy, the transformation of the labor market is also dramatically changing the requirements for human capital. As a result of automation and robotization, simple types of work are reduced, and the demand for highly qualified, creative and analytical specialists is increasing. According to the World Economic Forum, by 2025, more than 40 percent of existing professions are expected to be transformed. This requires a review of the human capital development strategy.

Also, the development of the "gig economy" and remote work in the digital economy is creating new mechanisms for influencing labor productivity. Remote work reduces the time and transportation costs of employees, increasing work efficiency. At the

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same time, a global labor market is being formed, creating new opportunities for highly qualified specialists.

In the context of the digital economy, the institutional framework for the development of human capital is also of great importance. If the interaction between state policy, the education system, scientific research and the business environment is effective, the development of human capital will accelerate. Therefore, state support for digital education programs, the development of innovative infrastructure and financing of scientific research are important.

A model of the complex impact of digital competencies and human capital on labor productivity

Indicators	Low level (traditional economy)	Intermediate (partially digital)	High level (digital economy)	Innovation level (Industry 4.0)
Human capital quality	Basic knowledge	Professional skills	High skill	Expert level
Digital competence	Minimal	Basic IT skills	Analytical and technical	AI, Big Data, creative
Technology level	Manual management	Partial automation	Digital systems	Full automation
Work speed	Low	Average	High	Very high
Error rate	High (10–15%)	Average (5–10%)	Low (2–5%)	Minimal (<2%)
Innovative activity	None	Low	Average	High
Labor productivity index	100%	120–140%	150–180%	180–220%
Value added	Low	Average	High	Very high

As can be seen from this table, when human capital and digital competencies are developed in tandem, labor productivity increases exponentially. In particular, at the innovation level, production efficiency can increase by up to two times.

In developing countries, including Uzbekistan, there are still problems with human capital development, which are mainly explained by the outdated education system, insufficient digital infrastructure, and the mismatch of the personnel training system with market requirements. According to the World Bank, more than 60 percent of the workforce in developing countries does not have sufficient digital skills.

Therefore, the human capital development strategy should include the following main areas: first, adapting the education system to the requirements of the digital economy; second, introducing a system of continuous education and retraining; third,

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encouraging innovative activities; fourth, strengthening cooperation between the state and the private sector.

The above analysis shows that the relationship between human capital and digital competencies creates a synergistic effect in increasing labor productivity. As a result of this synergy, production efficiency increases sharply and economic growth rates accelerate. Therefore, it is necessary to give priority to human capital in modern economic development strategies.

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