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DIGITAL TRANSFORMATION AND TOTAL FACTOR PRODUCTIVITY: KEY TRANSMISSION CHANNELS OF INFLUENCE

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In the context of modern discussions about the relationship between digital transformation and sustainable development, the combination of digital and "green" strategies is of particular importance, since it is their interaction that determines not only the trajectories of productivity growth, but also the potential for reducing structural asymmetries of development, which justifies the appeal to the results of research [1–2], which reveal the conceptual connections between the "green" and digital economy within the sustainable development paradigm. Digital transformation in the modern economy appears not as a separate technological trend, but as a structural mechanism for changing the logic of productivity formation at the enterprise level, which at the same time creates the prerequisites for reducing the "digital divide" [3] and, through the wider spread of technological capabilities, increasing data availability and the formation of new competencies. Its impact on total factor productivity is realized through a system of interconnected transmission channels that simultaneously alter companies' innovative capabilities, cost structures, resource allocation mechanisms, and the quality of human capital. Digital transformation is interpreted as a factor that not only increases the efficiency of individual processes, but also restructures the internal architecture of production, management, and interaction in value chains.

Digital transformation as a factor in increasing total factor productivity unfolds in the broader context of global competition and "technoglobalism", within which technological capabilities increasingly determine the positions of countries and companies in the international division of labor, access to innovative resources, and the ability to integrate into global value chains [3; 4]. In this environment, digital technologies act not only as a tool for internal optimization but also as a strategic asset in the competitive struggle, since control over data, platforms, and digital infrastructure forms new asymmetries of development and, at the same time, opens up opportunities to overcome them. Of particular importance is the transformation of the labor market, where digitalization is driving the spread of flexible forms of employment and the «gig economy», which is changing the mechanisms of human capital formation, the structure of demand for qualifications, and the nature of labor productivity [5]. On the one hand, platforms expand access to economic

activity, creating new channels of inclusion in production networks; on the other hand, they increase the risks of segmentation, employment instability, and uneven distribution of digital benefits. Accordingly, increasing productivity through digital transformation should be considered in light of the competitive dynamics of a techno-globalized economy and shifts in the labor market, where digitalization simultaneously creates new growth opportunities and new challenges to socio-economic inequality [6].

In this logic, four key channels of digital technology's influence on TFP can be distinguished: technological innovation, reduced operating costs, increased efficiency in resource allocation, and improved human capital structure. Their action is cumulative: digital solutions create an environment in which productivity growth results from the simultaneous optimization of knowledge, information, organization, and work.

The first channel relates to the transformation of innovation processes. Digitalization changes the very model of technological development of enterprises, transferring innovations from closed internal cycles to open network formats. The introduction of big data, cloud computing, artificial intelligence, and the Internet of Things expands companies' ability to process information, accelerates knowledge exchange, and increases the speed of development of new products and technological solutions.

Industrial Internet platforms play a special role as the basis for integrating digital technologies into the industrial economy. They ensure the integration of all links in the production process into a single network, where coordination of supply, production, service, and sales is carried out based on real-time data. This means that productivity increases not only through automation, but through the creation of new production organization systems that cover the entire value chain. The second channel is to reduce operating costs. The integration of digital technologies into production and management processes enables more accurate planning, automates routine operations, and reduces maintenance costs. Intelligent devices collect data in accordance with program commands, analyze production parameters, and support decision-making, thereby reducing dependence on manual control and personnel costs in traditional functions.

The third channel concerns improving the efficiency of resource allocation. Digital technologies increase the transparency of information in the company, reduce information barriers between departments, and strengthen management discipline. This reduces the risks of over- or under-utilization of labor and increases the efficiency of investment in personnel. In supply chains, digitalization reduces information asymmetry between companies and their partners. The use of blockchain, big data, and cloud solutions enables more accurate demand forecasting, optimized inventory, and greater network coordination efficiency.

The fourth channel concerns improving the structure of human capital. Automation is replacing some low-skilled jobs, while demand for highly skilled workers with digital competencies is growing. This contributes to the modernization of the company's human capital and enhances the diffusion of knowledge, organizational learning, and increased productive potential. Additionally, digital transformation is shaping a new configuration of competitive advantage, in which productivity depends on companies' ability to accumulate and use data as a strategic resource. Data serves as the basis for demand forecasting, logistics optimization, new product development, and improved quality of management decisions.

Empirical results confirm the effectiveness of all four channels. Digital transformation increases spending on “research and development”, the results of technological innovations, and their efficiency, while reducing operating and administrative costs. It also improves the efficiency of investment in labor, optimizes the functioning of supply chains, and raises the educational level of workers. The effect of digital transformation is systemic and emphasizes the need for a comprehensive approach to the implementation of digital technologies to maximize productive benefits and reduce structural digital asymmetries.

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