UDC 339.922:658.589

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European Integration of Ukraine and Industry 4.0

The promotion of the concept "Industry 4.0" facilitates the EU integration of Ukraine as it is a key factor of all-round digitalization and cyber-physical transformation of manufacturing as a means of rendering an economy more productive and efficient.

The strategic goal of Ukraine's foreign policy is integration into the world structures and international organizations. The relatively high economic, scientific, technical, mineral and raw material, and labor potential, as well as beneficial economic-geographical and geopolitical position in the center of Europe create objective conditions for ensuring mutually beneficial international division of labor, specialization, co-operation and integration into the world economic space.

The russian invasion in Ukraine has only accelerated the historic decision taken by the European Union to grant Ukraine the status of a candidate. Ukraine's integration into the EU has decisive geopolitical consequences for Ukraine itself and for the European continent [5].

At present, Ukraine's real goal is to complete the negotiations on accession to the EU in 2027-2028 and to expect full membership in 2029, when new elections to the European Parliament and the formation of a new European Commission take place. The development of Ukraine in the sphere of digital transformation and rapid spread of "Industry 4.0" are the most important components in the euro-integration process.

Digital transformation is a process of transition to a digital economy, which includes not only the transition to new technologies, but also a gradual restructuring of the usual management principles, a change in approaches to human resource management.

Digital transformation affects all aspects of an organization's operations. Changes go along the chain in many areas: in technologies, culture, operations and management approaches, creation of new products and services, in external communications. Processes and work models are completely transformed, obsolete technologies are eliminated.

The digital economy is rather the result of digital transformation, which we should come to. This is a new economic order, which is based primarily on data, as well as on knowledge and digital technologies. It forms new digital skills in people and opens up new opportunities for society, business and the state.

The main goal of digital transformation in public organizations is to rethink and redesign all business processes:

- modernization of infrastructure, transition to platform solutions;
- improving channels of interaction with citizens and other government agencies by reducing the number of processes;
- transition to systems of algorithmic regulation of public administration;
- new quality and culture of decision-making based on data.

Like any change, digital transformation, according to experts, will be associated with negative trends:

- the growing difference between the leaders of digital transformation and organizations lagging behind them;
- the rapid obsolescence of various specialties and the release of the labor force;
- increase in migration flows due to the growth of remote jobs;
- the need for continuous education or advanced training of employees in order to meet new requirements [1].

The world has already experienced three industrial revolutions. To imagine the scale of the changes that will occur to society as a result of the fourth industrial revolution, let's briefly review the previous three.

The industrial revolution is a qualitative change in the life of society, associated with the emergence of new approaches to production.

We are talking not only about the economic structure, but also about the whole life of society as a whole. Changes inevitably also affect the social, political and cultural spheres of society.

The first industrial revolution took place in the late 18th and early 19th centuries. It all started with the textile industry: people invented a mechanical loom and a steam engine to provide energy for new mechanized factories, then metallurgy, heavy industry and other industries began to develop. Due to all this, humanity has moved from an agrarian society, where agriculture was the basis of the economy, to an industrial one, in which resource extraction and industry began to play a key role.

The second industrial revolution took place in the late 19th and early 20th centuries. Its key event - the mass introduction of the conveyor - has significantly increased the speed and volume of production.

Thanks to the spread of conveyor production, the division of labor advanced, and the mass market was born. The chemical industry began to develop the foundations of modern electrical networks: power lines, incandescent lamps, generators and transformers. The telephone and telegraph, the first photo and movie cameras, black and white silent films appeared.

The third industrial revolution began in the 1980s. Its main features are the transition from analog technologies to digital ones, and the widespread automation of labor. Industrial robots have appeared, the Internet and computers are becoming available to ordinary users.

Digital transformation is often associated with the fourth industrial revolution. The number of contacts, transactions and interaction participants is increasing. This is a significant difference between the fourth industrial revolution and all previous ones. If Industry 4.0. is defined as a technological leap aimed at creating industries and providing new types of services, then digital transformation is a broader concept that includes both the manufacturing sector and the public sector. This process affects all aspects of the development of society. We are talking about a global qualitative transition to a different management model. In order for it to become possible, several global technological prerequisites must be present at the same time: the growth of the volume of data, technologies for storing and processing it, as well as ready-made and

widely used infrastructure, which is constantly used by customers, manufacturers, intermediaries and the state [2].

Industry 4.0 is an updated concept of the "smart factory", identified with the Fourth Industrial Revolution and the emergence of cyber systems. It is the next phase of digitization, where technologies such as Big Data analytics, predictive analytics, machine learning, m2m communications, artificial intelligence, additive technologies, a new generation of robots, etc., play a key role.

"Smart factories" (smart factory, "intelligent" production) is a concept of digitalization of industrial production with the aim of improving their operational and business efficiency.

Smart factory appeals to technologies such as cloud computing, wireless communications, remote control and maintenance, cyber security, integration of management systems, integration and better collaboration in the value chain, 3D printing and others. Due to the gradual decrease in the cost of these technologies, they become affordable, that is, they are increasingly used by industry and business, which eventually affects existing business models or creates new ones altogether [3].

The target industries in Ukraine for the implementation of relevant Industry 4.0 initiatives and projects:

- Engineering.
- Metallurgy and mining industry
- Branches of processing and food industry.
- Light industry.
- Energy - production, transport, distribution of energy resources.
- Infrastructure facilities - networks (such as gas, oil), seaports and airports, railways, roads, etc.
- City infrastructure - security, traffic, buildings, utility and power grids, etc.
- Agro-processing industry.
- Military-industrial complex.
- Aerospace industry.

If Ukraine does not join the world process 4.0., then in the next 5-10 years (until 2030E) this will mean:

- The final disappearance of a number of Ukrainian high-tech segments, dependent in their competitiveness on 4.0 technologies, primarily mechanical engineering, electric machines and equipment, instrument engineering, biopharmaceuticals, and energy.
- The final decline of a number of scientific institutions and numerous departments of higher education institutions corresponding to the specified fields. This, in turn, will lead to a sharp reduction in the educational, engineering and scientific potential of the country.
- High import dependence not only of construction, but also of engineering.
- The final fixation of the economic structure on natural resources and raw materials.

Digitalization not only leads to the disappearance of professions and a decrease in the use of human labor, but also creates new industries (sectors, professions), provides unlimited opportunities for the realization of human skills and talents.

The movement of the economic system is determined by the fact that it is constantly under multidirectional internal and external influences. Such impacts affect the state of the system, which is characterized as stable or unstable. If the system loses its stability, then the deviations in its motion increase. The interaction of the elements of the system changes, some connections are destroyed and new ones appear. Coordinating processes arise in the system, a new order of the system and a new stable state are organized. The process of real movement of the economic system is the interweaving of these processes. The first of them expresses the behavior of the economic system within cycles, i.e., reflects the process of its functioning; the second is a qualitative rebirth, the transformation of systems. The development and transformation of systems are characterized by a change in quality, while the dynamics of qualitative parameters within one stage of the transformation of the system will be limited. The specificity of transformation processes makes it possible to identify their general patterns:

• Instability. This state corresponds to the phase of its maturity. Transformation processes violate the state of the integrity of the economic system, turning it into a mixed one, where elements of the old and the emerging new system coexist.

• Nonlinearity. The nature of the transformation processes interrupts the slow evolutionary development; and these processes act as a qualitative leap, or a civilizational shift, according to the transformational concept of transitional states. Researchers of this process pay attention to the emergence of the so-called bifurcation points (changes) suggesting the emergence of alternative development paths.

• Transitivity. The state of transition presupposes a period of special contradictions, involving the struggle between old and new phenomena. This pattern is determined by the time of "victory" of new elements over the "old" ones, which means the transformation of a mixed transitional and unstable state into a new, organically stable system, which becomes stable.

• Globalization. The transformation process ends with a transition to a new qualitative stage of development, which eventually affects all countries. It usually starts in developed countries. The meaning of the transformation of the economic system is to create living conditions for the population, while the volume and structure of social production, its compliance with the structure of internal needs are important.

Any model of the development of the national economy is not only a kind of combination of internal and external factors determined by national or geopolitical characteristics, but also has specifics related to various historical stages and associated with the basic conditions at each of them.

The criterion of socio-economic progress is inevitably felt and controlled both by society as a whole and by its individuals, and, ultimately, focuses on society's assessment of the dynamics of the country's productive forces as a factor and condition for a stable positive change in the level of the nation's welfare.

Currently, the EU and other countries are visited by a large group of Ukrainian professionals in the sphere of digital innovations, cluster and industrial development. These areas are key to the strategy of the platform Industry4Ukraine. The purpose of the initiative "Ambassadors of Industry4Ukraine" is to increase the level of cooperation of Ukrainian participants with European and world programs of assistance to Ukraine. Main goals of the network "Ambassadors of Industry4Ukraine":

• Integration of Ukrainian SMEs and developers into existing EU projects

• Financial and other assistance from existing EU projects and their participants in support of Ukrainian developers and industrial Small and Medium-sized Enterprises (SMEs).

• Promotion of representatives of Ukrainian industry within the framework of events in the EU, with the possibility of sponsorship of separate events

• Promotion of existing initiatives of the platform Industry4Ukraine, Ukrainian cluster alliance, and other projects among European institutions and professional community.

• Joint development and lobbying of new initiatives to assist industrial communities at the level of the European Commission and relevant institutions in EU member states.

The essence of the initiative is not simply to integrate into European programs, institutions or chains of individual scientists or developers, but rather to position this initiative as a tool to help the sustainable development of enterprises in Ukraine, to support the sectors of the Ukrainian economy and the enterprises that suffered from the armed aggression of the russian federation [4].

The EU-Ukraine association under the conditions of rapid expansion of Industry 4.0 creates new opportunities for sustainable development in the conditions of modern transformation of European integration processes.

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