**DOI: 10.54264/0084**

**OLENA CHUKURNA**
Doctor of Economics Sciences, Professor, Professor of the Department of Management and Marketing, Dean of the Faculty of Business and Social Communications, State University of Intellectual Technologies and Telecommunication; *e-mail: elenchukurna@gmail.com;* ORCID iD: 0000-0001-9285-7068

**OLEXANDR NAZARENKO**
Ph.D. of Physical and Mathematical Sciences, Rector, State University of Intelligent Technologies and Telecommunication; Department of Applied Physics and Nanomaterials; *e-mail: Duitz.od@gmail.com*; ORCID: 0000-0002-0187-0791;

**LEONID PANKOVETS**
postgraduate student of the third level of higher education, majoring in «Economics», State University of Intellectual Technologies and Telecommunication; e-mail: *ua0737772728@gmail.com*; ORCID ID: 0000-0001-5578-9385

s. 189-204

# FORMATION OF THE DIGITAL ECONOMY AS THE FINAL STAGE OF GLOBALIZATION

ABSTRACT

The article is devoted to the problem of the formation of the digital economy, as a consequence of the final stage of globalization. An analysis of the development of the digital economy and its periodization was carried out. The change in technological structures and the influence of technologies on the core of value formation was analyzed as it is the basis of economic development. It has been proven that the change of key technologies, which are the basis of technological systems, contributes to the change of the cost structure. The change of the paradigm of human development depending on the change of technological systems and technological revolutions was also analyzed. The evolution of the globalization paradigm and its impact on the emergence of the digital economy were studied. The transformation principles of the formation of the "Society 5.0" paradigm based on the technological basis of "Industry 4.0" were justified.

KEYWORDS

digital economy, globalization, digitalization.

## Introduction

The transformation of economic processes, connected with the change of economic models of doing business in the conditions of digitalization, led to a change in the paradigm of economic development. Of course, the formation of the digital economy is connected with the development of information and communication technologies, but also the change in its economic basis is of interest. In the context of the change of the economic paradigm in the conditions of the digital economy, the study of the influence of globalization on the transformation processes associated with the emergence of the digital economy is of scientific interest. The hypothesis of this study is the identification of the relationship between the influence of globalization processes on the economic basis of the digital economy.

**The aim of the study is** the analysis of the periodization of the development of the

digital economy, as a result of the influence of various factors of globalization.

**Result of the study.**

The concept of „globalization" was first used in economic terminology by the American scientist-sociologist R. Robertson, who in 1983 used this term in his article. In 1992, R. Robertson outlined the basis of his concept as the idea of the integrity of the world, caused by the spread of Western civilization.

Scientific studies carried out by members of the Club of Rome (A. Peccei, D. Meadows, Ya. Tynberg, J. Forrester) contributed to the spread and popularization of globalization ideas. In fact, it was the scientists of the Club of Rome who founded the first scientific school of global studies, which was engaged in global modeling, global problems, philosophical considerations about the existence of a person in the modern world, the values of life, and prospects for the development of mankind.

J. Forrester first substantiated the global problems of mankind in his study published in the book „*World Dynamics*" (1971). In this study, he underlined the fact that the further development of mankind on the physically limited planet Earth will lead to an ecological catastrophe in the 20s of the XXI century. D. Meadows summarized the studies of J. Forrester and proposed the method of „system dynamics" in his study „*The Limits of Growth*" (1972) [19]. However, the approach proposed by Meadows was not adapted to the regional world model and therefore attracted critical reviews. Despite some shortcomings, the Forrestrer-Meadows model was granted the status of the first Club of Rome report. In addition, the „*Limits to Growth*" study laid the foundation for a whole series of studies and reports by the Club of Rome, which provided in-depth development of issues related to economic growth, development, learning, the consequences of the use of new technologies, and global thinking. This approach became fundamental in the founding of the first scientific school of global studies, referred to as the "*Limits to Growth*". Subsequent research by the Club of Rome was based on the scientific works of M. Mesarovic and E. Pestel [21, c.13]. They proposed the concept of „*organic growth*", according to which each region of the world should perform its own special function, like the cell of a living organism.

In general, representatives of the first school of global studies, engaged in scientific research within the Club of Rome, rooted in their scientific views on an attempt to model global economic dynamics based on five interrelated variables (population, investment, use of non-renewable resources, environmental pollution, food production) and formed a working hypothesis about the dysfunctionality of the global system. The next work of the Club of Rome is the report of J. Tinberg "*Review of the International Order*" (1976). The approach outlined by J. Tinberg differs significantly from previous works and belongs to the second scientific school of global studies. He revealed specific recommendations regarding the principles of behavior and activity, the main trends of policy, and the creation of new or reorganization of existing institutions in order to ensure conditions for a more sustainable development of the world system. He developed the concept of sustainable development of the world economy. Other representatives of this school ( e.g. L. Brown) argued for the inefficiency and underdevelopment of traditional human society, the main cause and consequence of which is excessive demographic growth. The main goal of the concept of sustainable development, as seen by its authors, is the search for new ways that would ensure the progress of humanity not only in elite regions and in short periods (cycles), but also throughout the global space and in the long term [26, c.15-26].

The third scientific school of global studies called "*Universal Evolutionism*" was associated with the theory of Vernadsky's noospheric teaching, which was improved by N. Moiseev [23]. According to representatives of this school, global nature should be considered as a self-organizing system, the reaction of which, although not predictable due to the incredible number of critical threshold factors, is inevitable in the long term. The founders of this concept assume a reverse reaction of the biosphere to the processes of global development.

The fourth scientific school of global studies, "*Mitosis of the Biospheres*," was indirectly related to global studies, but is considered important in the theory of rationalization of humankind's environmental activities. The main representative of this school was M. Nelson [24.]. Nelson M. believed that the genesis of the eco-technical paradigm was determined by the practical needs of astronautics in the creation of small-scale artificial biospheres with specific qualities. The idea was to achieve improvement in the Earth's biosphere and for the formation of the noosphere, which was understood as the synthesis of the biosphere and techno sphere. Moreover, the techno sphere refers to a type of new culture, the distribution area of which will be the planetary market.

The fifth scientific school of global studies "*Controlled Global Development*", whose representatives were D. Gvishnani and E. Kochetov [13, c.15-26]. They consider globalization in the context of the information society, which pays significant attention to social problems.

The sixth scientific school of global studies, "*World-System Analysis*", founded by I. Wollerstein, developed a paradigm for the development of economies, histories of systems, and civilizations. The basis of this paradigm is the capitalist world, as the first historical form of the global system, developing in the interactions between the core, semi-periphery, and periphery of the world [28]. It is the capitalist economic system that is characterized by the process of reproduction of capital, which is accompanied by cyclical crises with a periodicity of 50-100 years. The paradigm of world-system analysis is close in conceptual principles to the concept of "*Global Socialization of Future Development*" proposed by the International Sociological Association.

I. Wollerstein's approach deserves attention since it is based on a study of the great historical period of the development of capitalism. This approach is based on the historical process of formation of the world economy, illustrating three stages of the formation and development of classical capitalism: simple cooperation (mid-16th century), manufacturing production (XVI-XVIII centuries), large machine production (XVIII-XX centuries). During the period of industrial revolutions in capitalist countries (starting from the middle of the 18th century) and the introduction of the electrical revolution (the last third of the 19th and early 20th centuries), the formation of the world economy was historically completed. In addition, this approach fully justifies the global heterogeneity of economic development, enhanced by the collapse of the USSR and the emergence of a new economic phenomenon, countries with economies in transition. The main approaches to substantiating the scientific concepts of schools of global studies are presented in Table 1.

Table 1.- Characteristics of the main schools of global studies [developed by the authors]

| Scientific schools of global studies | Representatives | Scientific approaches to global development |
|---|---|---|
| Scientific schools of the concept of *„Boundaries of Growth"* | A. Pecei, D. Meadows, J. Forrester, M. Mesarovic, E. Pestel | Modeling global economic dynamics based on five interrelated variables (population, capital investment, use of non-renewable resources, environmental pollution, and food production) and forming a working hypothesis about the dysfunctionality of the global system |
| Scientific schools of *„sustainable development"* | L. Brown, J. Tinberger | The idea of inefficiency and underdevelopment of traditional human society is the cause and consequence of excessive demographic growth. The highest goal of the sustainable development program is to find new ways to ensure the progress of humanity not only in elite regions and in short periods (cycles), but throughout the global space and in the long term. |
| Scientific Schools of "*Universal Evolutionism*" | V. Vernadsky, N. Moiseev | Global nature is considered as a self-organizing system, the reaction of which, although not predictable due to the incredible number of critical threshold factors, is inevitable in the long term. The initiators of the concept call for taking into account the reverse reaction of the biosphere to global development processes. |
| Scientific schools *„Mitosis Biospheres"* | M. Nelson | It is considered important in the theory of rationalization of humankind's environmental activities. The idea was to achieve results for improvement in the Earth's biosphere and for the formation of the noosphere, which is understood as the synthesis of the biosphere and technosphere. Moreover, by technosphere, we mean a type of new culture, the distribution area of which will be the planetary market |
| Scientific Schools of "*Controlled Global Development*" | D. Gvishnani, E. Kochetov | Considers globalization in the context of the information society, in which significant attention is paid to social problems. |
| Scientific Schools of World-Systems Analysis | I. Wollerstein | A paradigm for the development of economies, histories of systems, and civilizations was developed. The basis of this paradigm is the capitalist world as the first historical form of the global system, developing in the interaction between the core, semi-periphery, and periphery of the world |

All considered schools of global studies have different fundamental approaches to globalization as a process and concept of human development. There is no consensus regarding the interpretation of the historical conditions for the emergence of globalization, its conceptual foundations, and the paradigm for its further development. In the present, there are several noteworthy points of view regarding globalization processes in the context of their influence on the development of the world economy.

There are different periodizations of the globalization process. E. Maddison, in his study "*Outlines of the World Economy in 1–2030*," substantiated that human civilization in its development has gone through six stages of globalization. Based on this approach, seven stages of globalization were identified, which end with the stage of digitalization and the emergence of the digital economy [15] (Table 2).

It was under the influence of the fifth stage of globalization that international economic relations quickly developed, trade unions and organizations were created, stable interstate institutional ties were formed, and the migration of capital and labor increased.

The sixth stage of globalization began in the 70s of the XX century and is associated with the integration of the world economy and the emergence of transnational corporations. One of the most important achievements of the fifth and sixth stages was the GATT-WTO trade rules and the global payment systems SWIFT, VISA, and Europay.

Table 2.- Periodization of globalization [4,5]

| Stages of globalization | Average annual GDP growth, % | Average annual growth of world trade, % | Excess of trade growth over GDP (times) |
|---|---|---|---|
| Merchant capitalism, European colonization of America, East Indian trade unions (1500-1820) | 0.32 | 0.96 | 3.0 |
| Industrial capitalism, the growth of European global empires (1820-1870) | 0.94 | 4.18 | 4.4 |
| The Age of Imperialism, Financial Globalization (1870-1914) | 2.12 | 3.4 | 1.6 |
| Stagnation of globalization - World Wars. Great Depression (1914-1945) | 1.82 | 0.9 | 0.5 |
| Bretton Woods monetary system, GATT (1945-1973) | 4,9 | 7.88 | 1.6 |
| The golden era of globalization. Jamaican monetary system. WTO (1973-2010) | 3.17 | 5.38 | 1.7 |
| Digital globalization (2011- at present) | 3.14 | 10.44 | 3.3 |

At the turn of the 21st century, new trends have clearly emerged in the development of human civilization, moving towards networked rapprochement of countries and peoples on a planetary scale, towards intensive networked exchange of knowledge and technologies. The introduction of the term "*digital globalization*" is due to the fact that globalization is currently entering its new, digital phase, where digital flows of data and information are of great value, as they allow the movement of goods, services, finance, and people and have a greater impact on GDP growth than international trade and cross-border capital movements. Almost every type of cross-border transaction currently has a digital component.

World trade was once largely limited to developed economies and their large multinational companies. Digital globalization is now opening doors for developing countries, small companies, and start-ups, and for billions of people.

Digital globalization not only increases competitiveness but also opens up new channels of access to foreign markets and global electronic value chains.

The most important feature of digital globalization and the mechanism generating it at the end of the last – beginning of this century is the massive spread of the Internet, which led to the formation of a global information space and global communication hypersystems.

The reports from We Are Social and Hootsuite indicate that worldwide, the number of active Internet users in mid-2019 reached 4.333 billion people, and the number of unique mobile Internet users reached 3.937 billion people. The audience of social networks amounts to 3.534 billion people. Global Internet penetration among the population is 57%, and in North America and Northern Europe, it is 95%. Today there are 5.117 billion unique mobile users in the world, which is 100 million more than last year.

Digital globalization includes:

- formation and development of global electronic networks, production of intangible products, and services of IT companies;
- the emergence of fundamentally new cross-border virtual markets for transport, banking, and insurance services, as well as new financial markets operating around the clock;
- the emergence of new IT subjects of international interaction represented by TNCs in the field of the digital economy (Amazon, Alibaba, Uber, etc.), international economic organizations, consulting companies, and rating agencies.
- The global digital economy provides companies with new business functionality:
- constant access to the best suppliers, clients, labor, and financial resources, regardless of location;
- doing business "without borders": interaction in real-time with foreign clients and partners, managing supply chains on a global scale, supporting the activities of foreign employees during operations and customer service, instantly conducting cross-border transactions in remote markets;
- reducing costs for transactions, marketing, and interaction with clients in new markets;
- organizing virtual teams through the effective use of digital platforms that interact online;
- the transition of small enterprises and start-ups to the category of transnational ones from the moment of operation.

The widespread dissemination of digital technologies has significantly influenced the formation of a new stage of globalization - digital globalization, which provides companies with new business opportunities.

The global digital economy is changing business models, which entails a revision of the principles of interaction with customers, suppliers, and partners, including changes in the product line in accordance with changing customer preferences, as well as the conditions for the provision of products and services. The global digital economy opens up unprecedented opportunities to gain new knowledge, broaden one's horizons, master new professions, and improve skills. New social elevators are emerging, and the geographic horizons of opportunities are expanding.

The digital economy is the result of globalization, on the one hand, and the result of a change in technological structures, on the other. A change in the technological base creates opportunities for the introduction of innovative communication systems and digital ecosystems operating based on information and communication technologies. It is the creation of such models by the digital economy that allows globalization processes to reach a new level of business opportunities and rapid response to changes in influencing factors.

Let us consider the relationship between the mutual influence of globalization processes depending on the change in technological structures and the change in the paradigm of human development in these systems.

Starting from the mid-twentieth century to the present time, transformations have been observed in the world economy associated with changes in the technical and economic structure of society and global processes. The development and dissemination of

information and computer technologies, and digitalization of all spheres of life have contributed to the acceleration of communication processes and interaction between people. The transformation of socio-economic relations associated with the spread of information technologies was interpreted differently by different scientific schools.

In the 70-80s of the twentieth century, scientific views regarding the theory of a post-industrial or information society were widespread in the economic literature. These views had a significant impact on the development of the theory of value, which suggested the emergence of a new factor influencing value - information and knowledge. In this aspect, the theory of the information society has developed the concept of value, adding another significant factor to the socially necessary costs of the production of goods - information, which led to the emergence of the information concept of value.

This thesis was substantiated by D. Bell, who believed: «*If knowledge in its systematic form is used in the practical processing of existing production resources, then we can assume that it is these resources and not labor that are the source of value*»[1, p. 167].

In turn, the founder of the knowledge economy, Machlup, also assumed that new knowledge in the field of technology creates a tendency to switch demand from physical labor to mental labor [16, c. 38].

The famous scientist M. Castells considers the information economy as an era of globalization, in which the main source of labor productivity is the processing and use of information. That is, new information technologies serve as the material basis of the global economy [2].

The founders of the theory of the information society are united in their approach to substantiating the concept of value, the source of which is information and knowledge, and not material labor and traditional factors of production.

The concept of technological structures was first proposed by S. Yu. Glazyev and D. S. Lvov in 1986.

Technological structures are usually understood as groups of technological aggregates identified in the technological structure of the economy, connected by similar technological chains and forming reproducing wholes.

Each such structure is a holistic and sustainable formation, within which a full technological cycle is carried out, including the extraction and reception of primary resources, all stages of their processing, and the release of a set of final products that satisfy the corresponding type of public consumption.

The periodization and classification of technological structures according to S. Yu. Glazyev is presented in Table 3.

Table 3. - Periodization and classification of technological structures according to S.Yu.Glazyev [4, 5]

| Period of development | The core of the technological structure | Predominant infrastructure | Organization of production |
|---|---|---|---|
| 1770–1830 Beginning of the Industrial Revolution | textile industry, textile engineering, iron smelting, iron processing, canal construction, water engine | roads, irrigation canals | factory production |
| 1830–1880 Age of Steam | steam engine, railway construction, transport, machine and steamship construction, coal, machine tool industry, ferrous metallurgy | railways, shipping lines | mechanization of production, urbanization |
| 1880–1930 Age of Steel | electrical engineering, heavy engineering, steel production and rolling, power transmission lines, inorganic chemistry | power systems, post office, telegraph, radio communications, telephone, railways | standardization of production |
| 1930–1970 Age of Oil | automobile and tractor manufacturing, non-ferrous metallurgy, durable goods production, synthetic materials, organic chemistry, oil production and refining | expressways, power grids, pipelines, radio and television communications, shipping and airlines | mass production, increasing quality |
| 1970–2010 Scientific and Technical Revolution | electronics industry, computing, fiber optic technology, software, telecommunications, robotics, gas production and processing, information services | computer networks, satellite communications, Internet, global energy systems, airlines | networking, logistics, clusters, outsourcing |
| 2010–2050 Digital revolution | biotechnologies based on the achievements of molecular biology and genetic engineering, nanotechnology, artificial intelligence systems | global information networks and integrated high-speed transport systems | virtual services, 3D printers, Internet of things, cloud infrastructure |

The key shift in the periodization of technological structures is information. Since the 70s of the twentieth century, knowledge and information as a valuable good have become the property of the entire society, i.e. new factor of production. This creates conditions for the development of the fundamental principles of the information economy or knowledge economy.

During the development of the information economy, information acquires the following characteristics:

1. Information is the link between all economic stages. Information flow exchange systems are being introduced into the production process. Information is necessary for the functioning of all four stages of the reproduction process. To organize production, various information is used: technologies, standards, and processes. At the consumption stage, information also begins to be of a commodity nature.
2. Information can act as a specific economic good that is produced, distributed, exchanged, and consumed. In the process of materializing information, new technologies are created, and new products, equipment, and other intangible assets are developed.
3. Production at enterprises in the information industry has several features. The object of labor in this industry is primary information. the means of labor are all possible ways of converting, storing, and transmitting it, and the goal of production is customer satisfaction. In this regard, problems arise in assessing labor, the finished product, and the effectiveness of information activities.
4. Ownership of information is the basis of monopoly power since ownership of patents and licenses acts as a barrier to entry into an industry. There is another important aspect related to the transfer of information - the conditions for the sale of technologies. They may include restrictions that affect freedom of competition.

The features of the information product are the following:

- information does not disappear when consumed but can be used repeatedly. An information product retains the information it contains, no matter how many times it is used. This property of information is safety;
- an information product becomes obsolete over time. Although information does not wear out when used, it can lose its value as the knowledge it provides ceases to be relevant. In different fields of science and technology, the rate of depreciation of knowledge is different and can last from five to fifteen years;
- different consumers of information goods and services are comfortable with different ways of providing and delivering information because consuming an information product requires effort. This is the property of addressing information. Due to this property, as well as the property of aging, the need for an information product can never be satisfied once and for all;
- the production of information, in contrast to the production of material goods, requires significant costs compared to the costs of replication. Copying a particular information product is usually much cheaper than producing it. This property of an information product - the difficulty of production and the relative ease of replication - creates many problems in connection with the determination of property rights within the scope of information activity;
- lack of independence – manifests itself in the fact that the consumption of information is associated with the consumption of other resources.

Most of the methods used to determine the costs of producing information goods and services are based on the same principles that are used in estimating the costs of producing conventional goods and services.

The specificity of information as a commodity makes it difficult to determine the costs of its production using traditional methods. This is due to the difficulty of determining the relationship between costs and results of information activities. In cases where the factor of timely use of an information product plays a major role, the effect of information impact is disproportionate to the efforts expended on the production of information. Many information products and services have a short life cycle, but their timely use has a huge effect.

All these features of information, characterizing it as a factor of production, influenced the change in the structure of value. The periodization of changes in cost factors depending on the transformation of technological structures is presented in Table 4.

Table 4 - Periodization of changes in cost factors depending on the transformation of technological structures [3]

| Technological structure | Factor of production underlying the formation of value | Innovation component |
|---|---|---|
| The Second (1840-1890) and Third (1890-1940) technological structure | Labor, land (rent), capital<br>The cost is based on expenses | Technologies of light industry, technologies for producing water and steam energy, and mechanization of all industries based on the steam engine.<br>**Key Factor:** Steam Engine |
| The Third (1890-1940) technological structure | Labor, land (rent), capital<br>The price is formed on the basis of costs. However, the concentration of banking and financial capital increases the influence of capital as a factor of production. | Use of electricity, development of heavy engineering, chemical industry. The emergence and spread of radio communications, telegraph, and automobiles.<br>**Key Factor:** Electric Motor |
| The Fourth (1940-1990) technological structure | Labor, land (rent), capital<br>The cost is based on expenses | Development of energy using oil, petroleum products, and gas, as well as communications means of new synthetic materials.<br>**Key Factor:** internal combustion engine |
| The Fifth (1990-2020) technological structure | Labor, land (rent), capital, and information.<br>At the basis of cost formation, value for the consumer begins to play a significant role. The demand factor becomes decisive, based on the consumer's perception of the value of the product | Achievements in the fields of microelectronics, computer science, biotechnology, genetic engineering, development of new types of energy, outer space, and satellite communications.<br>**Key Factor:** gas technologies |
| The Sixth (from 1995 to present) technological structure | Labor, land (rent), capital, and information.<br>The cost is formed based on the value of the product to the consumer. | Development of biotechnology, medicine, nanotechnology, information and IT technologies, optoelectronics, aerospace industry.<br>**Key Factor:**<br>non-traditional energy sources |
| Seventh technological structure (from 2005 to present) | Labor, land (rent), capital, information and knowledge.<br>Cost is formed based on the value created by the enterprise (transnational corporations) | Development of neurotechnologies, genetic engineering, artificial intelligence, unmanned vehicles, and implantable technologies.<br>**Key Factor:**<br>non-traditional energy sources |

Thus, information, as a new factor of production, has become a key lever for transforming the economic basis. Based on the periodization of changes in cost factors depending on the transformation of technological structures, the evolution of marketing concepts based on a change in technological structures was formed.

For the development of production and society, it is important to master information as an inexhaustible cognitive resource, as well as transform the main types of economic activity that are associated with personal development into means of renewing and increasing this factor; this is where global progress lies.

The defining paradigm of human development in general philosophical terms is thinking, which is reflected in the term – "*homo sapiens*". The direction and characteristics of a person's behavior are determined by the specific historical conditions of his/her life and the system of values dominant in society. Within the framework of the general paradigm of "*homo sapiens*," sub-paradigms are developing in various areas of culture. In the context of studying the role of man in the socio-economic aspect, the following paradigms are of particular importance:

- „*homo faber*"
- "*homo economicus*"
- "*homo intelligences*".

"*Homo faber*" provides for the orientation of the human mind towards work and economic activity. "*Homo faber*", as an individual, is a holistic person with experience, skill, knowledge, profession, and qualifications and, at the same time, a partial element of a complex socio-economic system with a specific place in the system of social and manufacturing division of labor and a specific type of activity

„*Homo faber*" also includes internal motives for human activity. The main source of his existence is payment for labor or income from the application of his labor.

"*Homo economicus*" or economic man was formed in the 18th century and was reflected in the classical political economy of A. Smith, D. Ricardo, J.B. Say, and others. From the point of view of the relationship between producer and consumer, this person was formed from „*homo faber*". At the same time, he is engaged not only in production and consumption but also receives benefits.

A specific feature of "*homo economicus*" is the rationality of his behavior. The main motives of human behavior lie, first of all, in satisfying personal needs. Thus, egoistic principles predominate in him. For his rational behavior, an individual strives for the possession of private property, freedom of choice of activities, and information, strives to develop innovative abilities, and often takes risks.

Unlike "*homo faber*", whose main source of existence is salary, "*homo economicus*" has entrepreneurial income, profit, rent, interest, and dividend.

"*Homo intelligens*" is an educated person, with a high level of intelligence, informed, understanding that every person, on one hand, is an individual with his own interests, on the other hand, every person is a member of a collective, society, and therefore there are collective public interests that can be satisfied only on the basis mutual understanding.

The foundations for the transformation of the human paradigm and his role in socio-economic life were laid as society was transformed in the conditions of the development of scientific and technological progress.

The evolution of the human paradigm is closely connected and depends on the industrial revolutions that accompanied scientific and technological progress and the economic development of society. Namely, the Fourth Industrial Revolution or "*Industry 4.0*" contributed to the transition from the "homo faber" human development paradigm to "*homo intelligences*".

Table 5 - Four industrial revolutions according to K. Schwab [4,5]

| Industrial Revolution | Primary source of growth |
|---|---|
| 1770–1860: 1st Industrial Revolution – the era of steam and spinning | Steam engine, spinning, and weaving machines, metallurgy, turning |
| 1860–1900: 2nd Industrial Revolution – the era of steel and mass production | Telegraph, railways, internal combustion engine, conveyor belt |
| 1970–2010: 3rd Industrial Revolution – The Computer Age | Computers, electronics, nuclear energy, robots |
| 2010–2060s: 4th Industrial Revolution – the era of cyber-physical systems, the Internet, the digital economy | NBIC technologies, genetic engineering, 3D printers, renewable energy sources, drones, Internet |

Let us consider the technologies that underlay the industrial revolutions and created the conditions, for the development of scientific and technological progress in the future.
1st Industrial Revolution.

The first industrial revolution (late 18th - early 19th centuries) was caused by the transition from an agricultural economy to industrial production due to the invention of steam energy, mechanical devices, and the development of metallurgy.

**2nd Industrial Revolution.**
The second industrial revolution (second half of the 19th century - beginning of the 20th century) - the invention of electrical energy, the subsequent mass production, and the division of labor.

**3rd Industrial Revolution.**
The third industrial revolution (since 1970) - the use of electronic and information systems in production, which ensured intensive automation and robotization of production processes.

**4th Industrial Revolution.**
The fourth industrial revolution (the term was introduced in 2011, as part of the German initiative - Industry 4.0).

Industry 4.0. represents a transition to fully automated digital production, controlled by intelligent systems in real-time in constant interaction with the external environment, going beyond the boundaries of a single enterprise, with the prospect of combining Things and Services into a global industrial network.

In a narrow sense, Industry 4.0 (Industrie 4.0) is the name of one of the 10 projects of the German state Hi-Tech strategy, which was originally designed to last until 2020. This strategy describes the concept of smart manufacturing (Smart Manufacturing) based on the global industrial network of the Internet of Things and Services.

In a broad sense, Industry 4.0 characterizes the current trend in the development of automation and data exchange, which includes cyber-physical systems, the Internet of Things, and cloud computing. It represents a new level of production organization and value chain management throughout the entire life cycle of manufactured products.

The fourth industrial revolution is seen as a new level of organization and management of the value chain throughout the entire life cycle of manufactured products, which is characterized by the following areas:

- transition from simple digitalization (third industrial revolution) to innovation based on the integration of technologies (fourth revolution) into a single whole;
- the tendency of the physical, digital, and biological worlds to converge, leading to new technologies and platforms and the creation of cyber-physical systems;
- development of Internet services. New technologies have made it possible to find new ways to deliver goods to consumers, which has changed supply chains;
- increasing transparency in relations between the population and the authorities, as well as in the activities of government structures, leading to decentralization and redistribution of state power;
- radical transformation of the world community, including the social, economic, and political spheres;

- changing a person's position in the world, restructuring his inner world, relationships in the family and with society, transforming the usual way of life, everyday life, family, living environment, socio-economic processes in society, and the system of economic property relations.

The potential benefits of using Industry 4.0 technologies are the following:
- reduction in product maintenance costs by 10-40%;
- increase in labor productivity by 3-5%
- reduction of equipment downtime by 30-50%;
- reducing the time it takes to bring new products to market by 20-50%;
- increasing forecast accuracy up to 85%;
- reduction of quality assurance costs by 10-20%;
- reduction of inventory storage costs by 20-50%;
- increase in productivity of technical functions by 45-55% due to labor automation.

One can notice a clear connection and comparability of two concepts: technological structures and industrial revolutions. If we use the periodization of S. Yu. Glazyev and K. Schwab, the place of the digital economy on the time scale is 2010–2060, it organically fits into the final phase of the 6th technological order or the 4th industrial revolution. Since 2011, when the term Industry 4.0 was coined at the Davos Forum, many countries have begun developing government programs for the development and stimulation of digital transformation of industry.

In 2016, the Japanese government adopted a strategy for building "Society 5.0.", the foundations of which were developed on the initiative and active participation of the Japanese Federation of Large Businesses Kaidanren. The Japanese development plan aimed to solve the most important problems of Japanese society - population decline, aging, and childlessness of working citizens. It was the solution to these problems that formed the basis of the new paradigm, and in March 2017, at the CeBIT exhibition, which was held in Hannover, Japanese Prime Minister Shinzo Abe presented the "Society 5.0" program to its participants and the world community.

«Society 5.0.» implies a new historical type of organization of the socio-economic structure, replacing the four previous types: the society of hunters and gatherers (1.0), agricultural (2.0), industrial (3.0), and information (4.0) societies.

«Society 5.0.» represents a new social paradigm that replaces the information society (society 4.0), and implies the total spread of IoT (Internet of Things), the application of Big Data (technologies for working with huge amounts of data), and AI (artificial intelligence). Simply put, all socially significant processes in physical space are accompanied by the collection of information, which is digitized and sent to virtual space. There, based on its analysis and processing with the help of artificial intelligence, decisions are made that are again sent to the world of physical things. «Society 5.0.» is also commonly called "super smart society".

The essence of «Society 5.0.» is to combine the resources not of an individual person, but of society as a whole through the integration of physical and cybernetic spaces.
The paradigm of «Society 5.0.» is becoming a new stage of globalization, however, most countries have a long way to go before implementing this concept. Currently, the new paradigm requires the need to change national legislation and development strategies of states.

The transition to «Society 5.0.», like all previous technological revolutions, will be associated with semantic and ideological changes. All civilizational components will change, namely, the essence and functions of politics, economics, production, communication, religion, etc. The world is moving into augmented and virtual reality, which is becoming a part of people's lives. It is quite possible that technological gaps in societies between 2.0 and 5.0 will lead to new crises and political manipulation, and will also make them even more dependent on more developed countries.

Mitsubishi Electric Corporation, being one of the world leaders in industrial and infrastructure innovation, is actively involved in the creation and implementation of the «Society 5.0.» concept not only in Japan but also in other countries. The company, even today offers its partners solutions and services based on high-tech, reliable "smart" systems that are ready for use in the digital economy and protected from cyber threats. For example, the e-F@ctory platform for industrial enterprises is one of the key elements of «Society 5.0.»

**Conclusions**

The article provides a thorough analysis of the development of the digital economy. It has been proven that the economic foundations of the digital economy are the result of globalization and the expansion of the world economy. The periodization of the digital economy is formed and the main stages of its development are defined. The change in the factors that shape the cost of the product depending on the change in technological conditions were discussed. Furthermore, the change of the paradigm of human development depending on the change of technological systems and technological revolutions was considered. The transformation principles of the formation of the «Society 5.0.» paradigm based on the technological basis of «Industry 4.0» were also presented.

**REFERENCES**

[1] Bell D. (1989) The Third Technological Revolution and Its Possible Socio-Economic Consequences. Dissent. Vol. 36, Issue 2, P. 167
[2] Castells M. (2000) Informacionnaja epoha: ekonomika, obshestvo i kultura [Information age: economy, society and culture]. M.: GU VHSE, 2000, 608 p.
[3] Chukurna O.P. (2016) Koncepcia marketingovogo cinoutvorenia v globalnoj ekonomike: monografia [The concept of marketing pricing in the global economy: monograph]. Odessa: Astroprint, 2016. 336 p.
[4] Cifrova ekonomika: pidruchnik. [Digital economy: [textbook] / T.I. Oleshko, N.V. Kasyanova, S. F. Smerichevsky. – K.: NAU, 2022. – 200 p.
[5] Cifrova ekonomika: kolektyvna monografia [Digital economy: Collective monograph / I.A. Pavlinov, L. K. Skodorova, E. I. Pavlinova [etc.]; Transnistria state University named after T.G. Shevchenko, Rybnitsa fil. – Rybnitsa: PSU, 2019 (Tesline type). – 260 p. : fig., tab. Bibliogr. la sfârşitul cap. – 30 ex.
[6] Cisco (2016). Where to Begin Your Journey to Digital Value in the Private Sector Economic Analysis. URL: *www.cisco.com/c/dam/en/us/ solutions/collateral/service-provider/value-at-stake.pdf*
[7] Deloitte (2019). What is Digital Economy? URL: *www2.deloitte.com/mt/en/pages/technology/ articles/mt-what-is-digital-economy.html*
[8] Exabyte economy: [textbook] According to scientific ed. Tatomyr I.L., Shulzhika Yu.O. Truskavets: POSVIT, 2022, 292 p.
[9] Gartner (2018). Top 10 Strategic Technology Trends for 2019. URL: *www.gartner.com/ smarterwithgartner/gartner-top-10-strategic-technologytrendsfor-2019/.*
[10] Global Education Futures Report (2018). URL: *www.drive.google.com/file/d/0B9ZvF6mQ5FMbSTFK VmhodU5rNTNiTXpUZ2QwZktiR0pzSmJR/view*
[11] European Commission (2018) Digital Economy. URL: *www.ec.europa.eu/jrc/en/research-topic/ digital-economy*.
[12] June 2015. URL: *www.mckinsey.com/~/media/mckinsey/business%20 functions*
[13] Kochetov E.G., Dubnitsky V.I Ukraina i jeje regiony na puti k innovacionnomy obshestvy. Globalistika, geoekonomika, mirovoj porjadok i novaja model bezopastnogo razvitia [Ukraine and its regions on the way to an innovative society. Global studies, geoeconomics, world order and a new model of safe development] [under the general. ed. I.P. Buleeva, V.I. Dubnitsky]. Donetsk: Yugo-Vostok, Ltd, 2011. T.1, 573 p.
[14] Lane N. (1999). Advancing the digital economy into the 21st century. Information Systems Frontiers. Vol. 1. № 3. P. 317–320.
[15] Maddison Engas. Kontury mirovoj ekonomiki v 1-2030 gg. Ocherki po makpoekonomicheskoj istorii [Outlines of the world economy in 1-2030. Essays on macroeconomic history] // Translation from English by Yu. Kapturevsky; edited by O. Filatocheva. M.: Gaidar Institute Publishing House, 2012, 584 p.
[16] Mahlup F. (1966) Production and spread of knowledge in the USA / F. Mahlup. – M: Progress, 462 p. c. 38
[17] Masuda Y. (1983) The Information Society as Postindustrial Society. Washington: World Future Society, 178 p.
[18] McKinsey (2017). A Future That Works: Automation, Employment and Productivity. URL: *www.mckinsey.com/~/media/McKinsey/Featured%20*
[19] Meadows D.L. (1977) Alternatives to growth-I: a search for sustainable futures. N.Y.: Ballinger Pub Co, 405 p.
[20] Mesarovic M., Mako D., Takahara I. Teoria ierarhichesrih mnogourovnevyh system [Theory of hierarchical multi-level systems] M: Mir, 1973, 344 p.
[21] Mesarovic M., Pestel E. (1974) Chelovechestvo u povorotnogo punkta. Doklad rimskogo kluba [Humanity at the turning point. Report to the Roman club] № 75, 73 p.
[22] Mesenbourg T. L. Measuring the Digital Economy. U.S. Bureau of the Census. URL: *www.census.gov/content/dam/Census/library/working-papers/2001/ econ/digitalecon.pdf*

[23] Moiseev N.N. Izbrannye Trudy. Mezhdiciplinarnye issledovania globalnyh problem. Publicistika I obshestvennye problemy [Selected works: Interdisciplinary studies of global problems. Journalism and social problems / [comp. : Yu. G. Evtushenko and others] [In 2 volumes] – M.: Tydex Co., 2003. – T.2:. 262 pp.
[24] Nelson M., Richard R., Winter S. J. (2000) Evolucionnaja teoria tkonomicheskih izmenenij [Evolutionary theory of economic change]. M.: Finstatinform, 286 p.
[25] Tapscott D., Ticoll D., Lowy A. (2000) Digital Capital — Harnessing the Power of Business Webs. Boston: Harvard Business School Press
[26] Tinbergen J. (1976) Revisiting the international order. Report to the Roman club. – №. 76, 45 p.
[27] Transformatsia socialno-trudovoj sfery v umovah cifrovizacii ekonomiki: monografia [Transformation of the social and labor sphere in the minds of digitalization of the economy: [monograph] / O.F. Novikova, O.I. Amosha, Y.S. Zaloznova, O.O. Khandiy, N.A. Azmuk, Ya.V. Ostafiychuk, L.L. Shamileva, O.V. Pankova, I.M. Novak, A.D. Shastun, O.Yu. Kasperovich, O.V. Ishchenko, Ya.Ye. Krasulina, L.P. Amelicheva, V.V. Company; NAS of Ukraine,
Institute of Industrial Economics. Kiev, 2022. 385 p.
[28] Wallerstein I. (1974) The Modern World-System. Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century. New York, pp. 18-80.

# KSZTAŁTOWANIE GOSPODARKI CYFROWEJ JAKO KOŃCOWY ETAP GLOBALIZACJI

STRESZCZENIE

Artykuł poświęcony jest problemowi kształtowania się gospodarki cyfrowej, jako konsekwencji ostatniego etapu globalizacji. Przeprowadzono analizę rozwoju gospodarki cyfrowej oraz jej okresowego podziału. Zbadano zmiany w strukturach technologicznych i wpływ technologii na rdzeń kształtowania wartości, stanowiący podstawę rozwoju gospodarczego. Udowodniono, że zmiana kluczowych technologii, będących fundamentem systemów technologicznych, przyczynia się do zmiany struktury kosztów. Rozważano zmianę paradygmatu rozwoju ludzkiego, w zależności od zmian w systemach technologicznych i rewolucji technologicznych. Przeanalizowano ewolucję paradygmatu globalizacji i jego wpływ na powstanie gospodarki cyfrowej. Opracowano zasady transformacji kształtowania się paradygmatu „Społeczeństwo 5.0", opartego na fundamentach technologicznych „Przemysłu 4.0".

SŁOWA KLUCZOWE

gospodarka cyfrowa, globalizacja, digitalizacja