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LOGICAL-HISTORICAL STAGES OF THE DEVELOPMENT OF THE INFORMATION NETWORK ECONOMY

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Інформаційно-технологічна революція докорінно змінила предмет та засоби праці, права власності, механізми формування вартості та ціноутворення. Дані процеси знаменують становлення інформаційно-мережевої економіки, проте вони не узгоджуються з капіталістичними ринковими законами.

Автором запропоновано періодизацію та характеристику етапів становлення та формування інформаційно-мережевої економіки, в основі якої лежить теоретична концепція проходження кожною системою наступних етапів: становлення, формування, розвитку на власній основі, виникнення чужорідних елементів, розкладання та зникнення.

Етапи становлення і формування інформаційно - мережевої економіки, згідно з цією логікою, супроводжуються виникненням чужорідних елементів і розкладанням системи індустріально-ринкової економіки відповідно. Етап становлення характеризується виникненням поодиноких явищ інформаційно-мережевої економіки в середовищі індустріальної системи і включає фази протогенеза і генезису. Результатом індустріального перелому і капіталістичної реструктуризації стало виникнення нових організаційних форм, а саме перехід від вертикально інтегрованих до горизонтальних структур.

На етапі формування нова система починає конкурувати зі старою, прагне до самоствердження. Початок формування інформаційно-мережевої економіки припадає на 90-ті рр. XX століття. Загальними характеристиками цього етапу є виникнення мережевих ринків, електронного бізнесу та електронних грошей, реструктуризація форм господарювання на базі ІКТ. Фазами даного етапу є переважно екстенсивне та переважно інтенсивне формування. У статті наводиться аргументація положення про незавершеність переходу інформаційно-мережевої економіки до етапу розвитку на власній основі.

Ключові слова: посткапіталіз, інформаційно-мережева економіка, процес розвитку, криза капіталізму.

Relevance. Defining role of information as the main distinctive feature of modern evolutionary processes has caused scientific discussions concerning theoretic explanation of transformation of social and economic system under the influence of information technology revolution, globalization and development of network economy. The industrial age crisis and formation of an information society have led to drastic changes in productive forces and production relations: information technology blurs the lines between working and spare hours, undermining basics of cost fixing and price formation, it influences the subject of labour – new materials, which are absent in nature, are created with given properties. Since the main functions of a worker are collection, processing, analysis, transfer of information, the information itself turns into the subject of labour, which is processed in the process of intellectual activity; requirements to educational level and professional qualification are changed along with it. Requirements to labour resources in the post-industrial society fundamentally differ from those, which were relevant to industrial workers: tasks on design, data analysis, and management of network processes will replace equipment operation skills in the profile of workplaces. Increase in the number of jobs is expected due to the expansion of demand for database management specialists, scientists, software developers, analytics and information security specialists [1, p.11].

Computing capacities and communication networks have become the means of intellectual products production, because of their expansion industrial relations are changing in the direction of creating voluntary forms of organization, activity decentralization, which are not covered by market mechanisms.

“Earth, labour and capital stopped being those fundamental categories of economic analysis which they used to be for two centuries. This simple classification was replaced by people, ideas and things… usual scarcity principle was augmented by an important sufficiency principle” [2, p. 161]. Introduced tendencies suggest that development of the information network economy is taking place.

Analysis of recent research and publications. Attention to the information as an economic category appears together with attempts to explain social and economic changes with the help of D. Bell’s theory of post-industrial society [3], theory of information society and economy. Significant contribution to the economic analysis of information was made in the field of studying the problem of uncertainty and markets with asymmetric information.

Peculiarities of network economy functioning were analyzed by C. Shapiro and H. Varian [4], R. Viber [5], K. Kelly [6].

Works of P. Mason are devoted to the problems of development of post-capitalist society [2].

Russian scientists S. Dyatlov [7], I. Strelets [8] have also made an input into the development of the information network economy, analysis of network goods and network effects.

Works of A. Hrytsenko [9], devoted to the problem of network human-being, A. Maslov [10] must be mentioned among national scientists.

The purpose and tasks of the article. The purpose of the article is recreation and analysis of the development stages of the information network economy.

In accordance with the set purpose its tasks are:

−to reveal specific features of the influence of information resource on functioning of social and economic system;

−to give definition of the information network economy;

−to define contradictions of information economy functioning on the basis of capitalism.

Main results of the study. The concept of the information network economy is not widespread in the scientific literature, only its separate characteristics are reviewed: transformation of the information role is studied regardless of the processes of network organization formation and transfer of economic activity into virtual space. Taking this into consideration, periodization of the development stages of the information network economy in unity is suggested, its main criteria are change of organization forms, development of information technology and its integration into economic activity.

This basis of this theoretical concept is the philosophy idea that each system goes through the stages of the origin, formation, development on its own basis, the emergence of alien elements, decomposition and extinction.

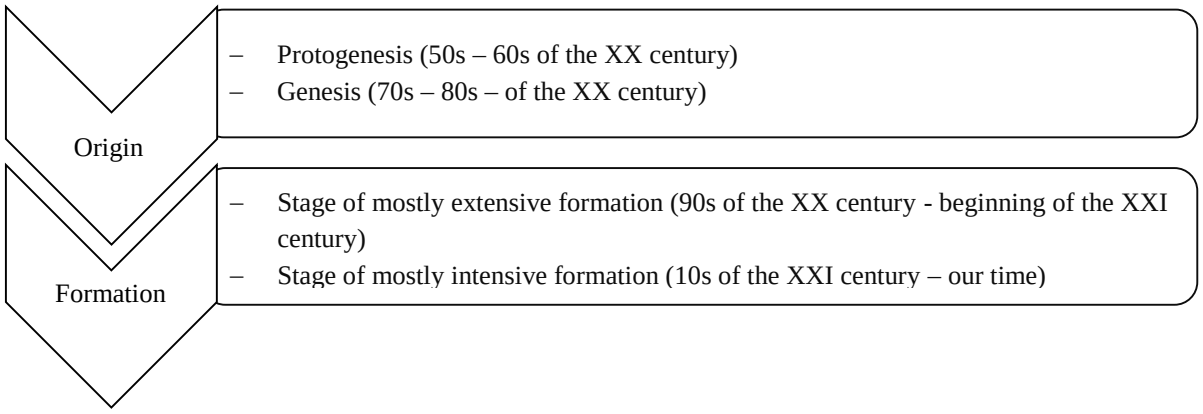

Figure 1 – Development stages of the information network economy, author's compilation

The occurrence of singular phenomena of the information network economy in the environment of industrial system takes place at the origin stage.

The following categories are introduced into the scientific use: "knowledge economy", "information economy", "information society", which put emphasis on the fact that the influence of information resource on economic development increases.

Protogenesis of the information network economy happened with the beginning of information technology revolution. The first programmable electronic computer was created in the field of military industry in 1946 (ENIAC, comes from Electronic Numerical Integrator and Computer). The first new scientific studies devoted to the problems of use of information technology for data processing for the purpose of increasing economic efficiency were carried out in the 50s of the XX century. However, practical use of the results of this period was limited to military and research fields.

The theory of information and implementation of transistors enabled automation of physical processes and transformation of manual labour into the control activity over them.

The third generation transnational companies in the form of group corporations and conglomerates play an important part at this stage. Transnational companies promoted expansion of the achievements of scientific and technological work in the peripheral zones of the world economy and formed economic conditions for appearance of the international production with a single market and information space, international market of capital and labour force, scientific and technological services.

System-oriented information technology with its own standards is developed. In the 70s of the XX century appearance of large universal high-performance servers created conditions for carrying out direct digital management in real-time mode.

Origin stage of the information network economy accounts for the fourth long-term wave founded by Kondratiev. Manufacture of internal-combustion engines, automobiles, development of chemical industry led to the longest economic boom in history, however, an oil shock took place and period of instability occurred in 1973. New organization trends have occurred as a result of capitalistic restructuring and industrial turning point, in particular, transfer from vertically integrated organization structures to horizontal ones, creation of telework for the purpose of saving energy resources for the use of transport and attraction of information technology potential.

Japan became the only developed country, which managed to rationalize models of business conduction in the industry and make first steps towards reorientation to flexible working hours after the crisis.

Major technical achievements of this period are transfer of ARPANET network, which was founded by the order of the Ministry of Defense of the USA for unification into a network of research and military institutes in the USA for a new protocol dd. January 1, 1983. This date is considered an official date of Internet foundation.

Transition to the formation stage begins from the 90s of the XX century and it is characterized by creation of a new system, which starts to compete with the old one, strives for self-affirmation. General characteristics of this stage are reduction of expenses on information processing, storage and transfer as the result of innovations, creation of network markets, electronic business and electronic money, creation of new business patterns on the basis of Information and Communication Technologies.

Technical preconditions for the formation of the information network economy are development of information technology focused on personal computers, mass production of the latter, improvement of other information and communication technologies (cellular communication, wireless technologies), their large-scale use at enterprises, organizations, institutions, creation of local computer networks.

In the early 90s, introduction of digital technology in telecommunication networks, development of broadband signal transmission and increase of the efficiency of computer networks contributed to the introduction of flexible management, production, distribution processes, which include cooperation between different companies or their branches. New technologies were built into the old capitalism structures, changing it qualitatively.

The process of globalization of world economic relations has led to the confirmation of global fourth generation transnational companies, which differ by qualitative characteristics: action coordination of branches takes place on the basis of new information technology; flexible organization of each industrial center; adaptability of corporation structure; unification of the product output on the international scale and organization of production together with enterprises, which are geographically remote and have different national affiliation; unification of branches, plants, common enterprises into one international management network, which, in its turn, is integrated with other networks of transnational companies [11]. Taking into account complexity of the management of such structures, corporate information systems for automation of planning, accounting, control and analysis of business processes, solving business tasks, ERP (Enterprise Resource Planning), MES (Manufacturing execution system) are introduced.

Network economy was originated in the 90s, when the World Wide Web was developed and business and mass media got an opportunity to use it, according to some sources it happened in 1995 [10, p. 13], test purchase of goods with a credit card via the online-store was made in the same year.

The era of globalization and commercial use of the Internet have actualized changes in approaches to management and activity organization. M. Hammer and D. Champi proposed a concept of business processes reengineering in 1993. The ARIS (Architecture of Integrated Information Systems), a software product for modeling business processes of organizations, was released in 1994. The author of this methodology was A.-W. Scheer. In the early 90s the transition to client-server architecture put on the agenda the problems of enterprise architecture building and its management.

Development of the Internet-oriented technologies contributed to the creation on the first Internet companies such as Amazon.com, Yahoo in the middle of the 90s, at the same time rapid development of search engines was observed. The global expansion of the Internet contributed to the rapid growth of the number of online-stores in 1998-2000.

Works devoted to the analysis of information influence on economic processes and problems of intellectual property (“Information rules”, authors C.Shapiro and H.Varian, 1999) were presented [4].

Due to the development of Information and Communication Technologies, the use of remote labor relations and freelance – network forms of employment, which provides the absence of a single employer and is expanded and implemented in virtual space.

Thus, the main organization change for the last two decades of the XX century is crisis of an old, rigid model, related to large vertical corporations and oligopolistic control over markets; the companies understand that their success depends on their ability to adopt new digital technologies.

It is worth mentioning that it is incorrect to apply a cause-and-effect link to the development of information technology and the emergence of new organizational forms. Their complexity, necessity to coordinate activity on the global scale, decentralization of decision-making, necessity to adapt to the change of the environment have created the need to develop information technology, computer networks in particular. It means that organizational forms contributed to the creation of new technological trajectories due to the large-scale need for flexible, interactive management, in its turn, information technology enabled development of new organizational forms. Formation of networks has become the key to the flexibility of organizations and business productivity [11].

At the end of the 90s main elements of the fifth long-term wave emerged. Its sources are network technologies, mobile communications, and information products.

Network technologies promoted relation changes in the financial field: crowdfunding was originated at the beginning of 2000. Crowdfunding is a collective cooperation of people, who voluntarily pool resources, usually via the Internet, to support efforts of other people or organizations. It is expected that crowdfunding will stimulate growth of the number of startups. Bitcoin, the first decentralized currency, was introduced in January 2009. Total capitalization of cryptocurrency market has grown three times since the beginning of 2016, having reached nearly $ 25 billion in March 2017 [12].

Financial institutes implement Blockchain technology, which is deemed as a decentralized database on transactions in the network, which is the basis for bitcoin, its main difference and advantage is division of the register.

The second formation stage of the information network economy related to the fourth industrial revolution, which is characterized by blurring distinctions among physical, digital and biological fields. It's definition as an implementation of "cyber-physical systems into the commercial runs" was originally presented at the industrial exhibition in Hannover in 2011 [13, 14]. Without carrying out the analysis, it seems that the recognition of the new industrial revolution is contrary to the formation concept of the information network economy, because it emphasizes that the new development stage, which means the transition from industrial to post-industrial society, did not happen, however, it only confirms the fact that business activity in the informational economy not only promotes development of the information sector, but also provides increase of efficiency in the field of material production.

According to the System initiative on formation of future production of the World Economic Forum in 2016, the main impact on the economic development will be established by five key technologies: Internet of things, artificial intelligence, robotic technology, portable computers and 3D printing [14].

An important development stage of the global network in creation of the Internet of things, characterized by connection of a large number of appliances, which carry out automated data processing without human input. In 2008-2009 the transition from the "Internet of people"to the "Internet of things" took place, which meant that the number of things connected to the network exceeded the number of people [14]. The expansion of practical implementation of the "Internet of things" has been a tendency of information technology since 2010. The McKinsey consulting company estimated the economic effect of this process at $ 6 trillion a year due to expenses reduction and efficiency improvement, primarily in the field of healthcare and manufacturing industry [2, p. 169].

Main directions of production development under the influence of information technology of the Fourth Industrial Revolution are listed in the table 1.

To some extent, development of these technologies are caused by the tendency of transition from mass production, which fails to meet the requirements of the market, to mass customization, based on a wide adaptation to the customers' requirements and satisfaction of individual needs of consumers. Now personalization does not lead to the loss of production output due to the Internet of things, artificial intelligence and 3D printing. Personalized products can be implemented in two ways: the first one involves physical personalization, which means that technologies create distinguished forms and functions and smart personalization, where sensors and an opportunity to connect create special digital offers. Readiness of the clients to pay for personalized products more leads to the increase in profit margin.

Introduced tendencies indicate that the process of development and formation of the information economy are based on a large-scale implementation of Information and Communication Technologies,

increase of the scale of economic activity, which is reached by being placed in various information and economic spaces [11, p. 82], that is why the information network economy can be defined as a form of organization of social and economic activity with network form of coordination, which is based on predominant use of information resources, information technologies and Internet global electronic network in the processes of production, distribution, exchange and use.

Table 1 – Influence of technologies of the Fourth Industrial Revolution on production process, prepared on the basis of [13, 14]

Connection and computing	Blockchain, mobile Internet, cloud-based computing, applications and platforms, modeling, visualization, M2M interaction (machine – machine; modules, modems and routers for communication mechanization)
Analytics and intellectualization	Cognitive computing, bioinformatics, intellectual data analysis, big data (big files of information with complex structure)
Philosophy of production	Management of life cycle of product made of modern materials, flexible, module production systems, energy/material/resource efficient production, sustainable production, re-used material, personalized mass production
Advanced materials	Materials for four-dimensional printing, nano-engineering of materials and surfaces
Improved production processes	Nanoassembly, production of highly effective flexible structures, ink-jet printing, 3D network production, 4D printing, flexible and reconfigurated machines and robots, automated robotic technology, remote service
Human – machine interface	Dialogue systems, social networks, augmented/virtual reality, portable computers

The generalizing characteristic of each stage of the development of the information network economy is reflected in Figure 2.

Protogenesis

- development of applied cybernetics;
- beginning of batch production of personal computers after the invention of the first microprocessor in 1971;
- presentation of works on evaluation of the impact of computers on modern organization;
- functioning of the third-generation transnational companies, which use achievements of scientific and technological work, emergence of conceptual fundamentals of the Internet, creation of network technologies

Genesis

- creation of new organization forms, which promoted mass expansion of information technology as a response to the industrial capitalism crisis in 1970s;
- achievements in the field of technologies speeded up the process of globalization and creation of networks of internal communication of regional and global scale

Stage of mostly extensive formation

- intrusion of information technology into every-day life;
- transfer of economic activity into virtual field;
- approval of global fourth -generation transnational company

Stage of mostly intensive formation

- recognition of the fourth industrial revolution;
- implementation of "cyber-physical systems" into the commercial runs

Figure 2 – The characteristic of origin and formation stages of the information network economy development, author's compilation

Summary. Information radically changes the process of production, distribution, exchange and use of the product, role of the country in defending national interests, process of business decision-making. Change of economy structure occurs, information sector forms, social structure transforms, creating new class – netocracy under the influence of informatization and development of network relations. These transformations are explained by the theory of the information network economy, which has gone through a few stages of its evolvement: origin and formation.

Transfer of the information network economy to the development stage on its own basis has not yet taken place, because the information-based economy, with its tendency to create products with no expenses due to their copying and blurred property rights, cannot be capitalistic. In addition to the fact that capitalism is destroyed by information, there are internal mechanisms (the neo-liberal concept and fiat money), which undermine its foundations and lead to deterioration, manifested in the inhibition of the fifth Kondratiev wave, in which low-paid jobs are created and many economies are in the state of stagnation instead of the rapid automation and abolition of manual labour [2, p.78].

P. Mason thinks that "there is growing evidence that information technology does not create a new, more stable form of capitalism, but undermines it, destroying market mechanisms, right of ownership and former interrelationships among wages, labour and profit" [2, p.135]. According to the methodological grounds, an old system shall disappear at the development stage based on this system. In isn`t functioning of information capitalism, as its form following the industrial one, but the transition from capitalism, which is built on market relations, to post-capitalism.

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