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INFORMATIZATION AS A CATALYST FOR TRANSITION TO THE KNOWLEDGE SOCIETY

The article considers that informatization is a cumulative process, since it is informatization that enhances the quality of interaction between engineering and technology, socio-economic relations and forms, building up the basis for macro generations in socio-economic systems and transforming social production at each stage of development. These dependencies are reflected in the authors' method of analyzing the current information cycle. The proposed methodology has become one of the blocks building up the authors' general algorithm for the analysis and management of the current information cycle, involving a comprehensive analysis and development of areas and methods for managing interphase and inter-stage transitions within the current transition period to the knowledge society.

Keywords: information cycle, informatization, knowledge society, post-industrial economy.

JEL classification: F63, O33

ІНФОРМАТИЗАЦІЯ ЯК КАТАЛІЗАТОР ПЕРЕХОДУ ДО СУСПІЛЬСТВА ЗНАНЬ

Сучасний розвиток людського суспільства є послідовним переходом від індустріальної до постіндустріальної епохи в напрямку створення суспільства знань. На основі зіставлення трактувань основних категорій сучасної економіки: «індустріальна», «неоіндустріальні», «інформаційна», «постіндустріальна», «інноваційна», «віртуальна», «цифрова», «неоекономіка», авторами виявлені рекурентні залежності. Визначено, що інформатизація виступає кумулятивним процесом, тому що саме вона створює нову якість взаємодії техніки і технологій, соціально-економічних відносин і форм, формуючи основу макророзвитку у соціально-економічних системах, трансформуючи суспільне виробництво на кожному етапі розвитку. Дані залежності знайшли відображення в авторській методиці аналізу сучасного інформаційного циклу. Виявлено, що кількісний аналіз може здійснюватися за двома напрямками: за оцінкою кумулятивних показників розвитку інформаційного середовища, де пріоритетне значення набувають наукові дослідження, а також за оцінкою з економічного боку, де на перший план виходить співвідношення економічних витрат і економічних ефектів від їх реалізації. Запропонована методика стала одним з блоків загального авторського алгоритму аналізу та управління сучасним інформаційним циклом, який передбачає комплексний аналіз і розробку напрямків і методів управління міжфазовими та міжетапними переходами в межах сучасного перехідного періоду до суспільства знань.

Ключові слова: інформатизація, суспільство знань, постіндустріальна економіка, інформаційний цикл.

Formulation of the problem. One of the main tasks faced by modern scientists is the development of theoretical and methodological foundations for assessing and managing the cyclical development of socio-economic systems of different levels and the search for key factors and mechanisms that form the basis of its phase shifts towards creating the knowledge society [1]. In this regard it becomes currently important to systemize the causes, identify the interrelations between the basic processes that form its essence, determine its time boundaries and highlight the peculiarities of each phase as well as interphase transitions, which makes these issues one of the most discussed ones. The variety of views and interpretations can undoubtedly testify to the complexity and consistency of the modern macro cycle, which is understood as a set of innovative, informational, social, technological, production, investment and structural processes that determine its essential characteristics, time boundaries, phase-by-phase structure, amplitude and depth of oscillations at each opera-

tional stage of a modern socio-economic system developing towards the creation of a knowledge society.

Analysis of recent research and publications. Despite the fact that there is a variety of definitions of the modern economy, the most well-known of them are the following: innovation economy [2–3], information economy [4–5], neo-industrial economy [6], digital economy and virtual economy [7], new economy [8]. However, at the same time, scientists interpret them ambiguously, focusing on identifying the distinctive essential features of each form of economic development in the current period, without touching on the issues of their interdependence or identifying the integrating process that forms the general vector of modern macroeconomic development.

In our opinion, resolution of these issues will reveal the general patterns of social development in general and sustainable economic development in particular, which can increase the efficiency of managing the progressive development of inno-

vative, technological, production, investment, social and structural processes towards the creation of a knowledge society.

The purpose of the article is to identify the specific features of the information cycle as a leading factor in the progressive development of innovation, technological, and production cycles at the present stage, which, in turn, involves specifying the tasks to be sequentially solved. The first task involves presenting a generalized description of the basic distinctive features that form the essence of social production on the basis of the definitional analysis of interpretations of modern economy. Secondly, it is necessary to highlight informatization as a key process and a specific feature of the transition period, which forms stable recurrent links with the innovation, production and technological cycles. The third task is to identify the peculiarities of the information cycle with the subsequent specification of the methodology and algorithm for its study.

Results and discussions. Solving the first of the above-mentioned tasks requires identifying and systematizing the essence of interpretations of the current stage of economic development towards creating a knowledge society.

Based on the theoretical and methodological analysis of the range of publications presented in domestic and foreign scientific literature, it may be inferred that the current stage of economic development is defined as "neo-industrial", "postindustrial", "innovative", "information", "virtual", and "digital" economy [2-8].

Therefore, in order to outline the relationships between these categories, it is necessary to reveal their essence, identify the characteristics of definitions and highlight a specific dominant process that transforms production.

Thus, a digital economy represents a "system of economic, social, and cultural relations based on the use of information and communication technologies" [9].

Its distinctive features are as follows:

- high level of automation;
- electronic document management;
- electronic accounting systems;
- electronic data storage;
- the use of GRM;
- deploying corporate social networks;
- the use of ICT in production, management, communications, etc.;
- electronic payment systems within e-commerce.

Its dominant processes that transform production are digitalization and computerization as the initial stage of digitalization.

Virtual economy is "a stage in the development of the information society", "a stage in the development of the information economy, a fruit of the scientific and technological progress of the second half of the twentieth century, combining the genius of the human mind and greed" (by the 1990s) [7].

Its distinctive features are the following:

- simulation of real life and economy based on online games;
- establishment and development of the virtual stock market;
- money circulation partially takes the form of fictitious capital;
- building up a new online sector;
- development of electronic trading in real and virtual goods and services;
- formation of informational thinking;
- service sector predominance.

Its dominant process, which transforms production, is the virtualization of society and the economy as a whole (the virtual economy partially replaces an already established economy).

Information economy represents a current stage of civilizational development, characterized by the predominant role of normative products and creative sector [5].

Its distinctive features include:

- research and development (R&D), which underpins the economy;
- establishment of the monetary and information form of capital;
- increased share of intellectual property;
- formation of an integrated human capital with a high share of professional intellectual property;
- information commercialization and sharing;
- individualization of labor market;
- structural changes in production due to information processes;
- emergence of a global management system.

The informatization of society and economy is the dominant process of this type of economy, which transforms production.

Neo-industrial economy is a type of economy characteristic of a new stage in the development of industrial economy [6].

Its distinctive features can be listed as follows:

- new knowledge and innovations that are created in the country, and not borrowed, associated with the emergence of new critical industries vital for the economy;
- increased public sector involvement in the financing of corporate R&D.

The dominant processes inherent to this economy type that transform production are the science-and-technology intensive industrialization of the economy and the comprehensive renewal and transformation of productive forces based on breakthrough technologies.

Innovative economy means a type of economy based on the flow of innovation, constant technological advancements, the production and export of high-tech products with high added value as well as technologies themselves [3].

Its distinctive features are the following:

- mass innovation, continuous improvement of innovation efficiency driven by their abundance and rising competition;
- increased number of venture companies;
- high level of science and education development;
- predominance of 4th-6th technological modes;
- development of the advanced knowledge industry and its export;
- a constant flow of both borrowed and created innovations.

Its dominant process transforming production is an ever-growing advancement of innovation in the economy and society in general.

Postindustrial economy is the economy of postindustrial society [10].

Its distinctive features include:

- high priority of the service sector;
- information becoming the main productive resource;
- intellectual and management activities becoming the main profit-generating areas instead of production;
- enhanced importance of a human factor;
- emergence of a new venture type of business.

The dominant processes of this type of economy that transform production include a trend towards a growing role of service sector in production (tertiary sector formation) and the “transition to the knowledge society”.

Neoeconomy is an economy based on the use of information to generate knowledge; it is a dynamically developing internationalized system of economic relations based on ICT and networking management models, i.e. it is the economy of the knowledge society [8].

It has the following distinctive features:

- emergence of information as an independent resource with specific value;
- establishment of informatization and the IT sector as a generator of socio-economic development;
- restructuring public wealth towards its information form;
- a finally established global society including all its features;
- virtualization of economic processes;
- enhancing human capital;
- quantitative and qualitative surge in the development of transnational corporations.

The dominant process of this type of economy that transforms production is the informatization of processes used to generate knowledge and innovation, which forms a "cumulative feedback loop" between innovations and areas of their implementation.

The presented analysis can be supplemented with the comparison criteria and economy types to systematize knowledge, as well as identify their distinctive features and basic characteristics. Its findings may also be used to specify the definitions of each highlighted type of economy in the form of a list of its basic distinctive features. However, the most important result of our study is the identification of the dependencies between them, which, as we see it, are based on the dominant process of production transformation.

Technological determinism makes it possible to single out the following relationships between the presented types of economy (Table 1), which will reveal the patterns of production transformation based on an objective change in the mode of production.

Thus, it is possible to distinguish the stages of economic development (industrial, transition (current), postindustrial) as well as the succession of the forms of

its development in the current transition period, which, in turn, allows us to discover not only the traditional direct relationships between the mode of production stemming from technologies, but also inverse relationships when the degree of sophistication of a production sector determines the general vector of economic growth, forming the basis for further technological and industrial transformation.

In accordance with the revealed dependencies, it becomes obvious that informatization as a process of formation, distribution, and commercialization of the new knowledge embodied in material means and subjects of labor, has an accumulative character transforming social production, as well as the formation and dissemination of innovation and technological progress.

At the same time, there has already occurred a change in the mechanism and trajectory of economic growth: without destroying traditional structures informatization creates an overall new quality of interaction between engineering and technology, economic relations and forms, institutional and social ties, thereby forming a synergistic effect of macro generation [11].

It seems that, of the entire set of cycles, the information cycle is dominant in modern society. In other words, the information cycle in its essence reflects the way of thinking, as well as the methods of information handling such as gathering, processing, generation, and subsequent commercialization, which serve as a basis for the subsequent accumulation of economic potential that indicates the opportunities and conditions of economic growth and progressive development [12].

However, the issue of whether regarding the information cycle as an independent type is expedient remains unresolved. For example, some authors define its essence as Kondratiev waves, the dynamics of which is determined by the general laws of the development of aggregate social knowledge, which has become a long-term factor of social development [11]. Others define the essence of the information cycle as a process of the development of information technologies, which in turn are regarded as ways of transforming information such as its storage, processing, and transmitting [12].

However, it is widely believed that the information cycle is a more progressive stage in the development of capital accumulation cycles that conclude the era of quantitative economic growth. This logically presupposes the creation of a system of qualitative development, which,

Table 1

Features of production processes depending on the stages of economic development

Forms of development	Dominant process transforming production	Features of production processes
Industrial economy and transitional forms that are typical of the current stage		
Neo-industrial economy	digitalization with simultaneous virtualization of the economy	comprehensive renovation and transformation of the productive forces on the basis of advanced technologies to increase the competitiveness and efficiency
Innovative economy	innovatization economy and society as a whole	enhance scientific and innovative production potential on the basis of borrowed technology and innovation
Information economy	informatization of society and the economy	enhance scientific and innovative production potential on the basis of its own innovations and information knowledge
Postindustrial economy		
Neoeconomy	serviceization of production; informatization of society and economy and practical implementation of information and telecommunication mechanisms of self-organization and harmonization	informatization of production, as well as informatization of the generation of knowledge and innovations, which forms a "cumulative loop" of feedback between innovations and directions of their use

Source: compiled from materials [2–10]

in turn, will serve as a foundation for the post-industrial economy of knowledge and advanced information technologies, providing for the shift of competition aspects from the material sphere (money-grubbing) to the intangible sphere of creativity, cognition, discovery of new meanings and images, intellectual and spiritual development [11].

Based on the above, the time boundaries of the information cycle can go beyond the long-term Kondratiev waves, since their trajectory is discrete, bordering the transition to a qualitatively new scientific and educational paradigm, reflecting the ongoing scientific, practical, informational and psychological transformations [11].

The characteristics of the information cycle highlighted above require a deeper study of its relationship with production, technological, and innovation processes that form the essence, amplitude and duration of the current macroeconomic cycle.

This type of relationship has been defined by the authors as recurrent, i.e. reflecting multilateral interphase and inter-cyclic dependencies in the general system of progressive social development.

Under the conditions of a new mode of production inherent to the new economy information becomes a direct and universal productive force, while scientific research becomes a key factor in the process of material production that forms a so-called "zero cycle" preceding the direct creation of a product. Thus, it can be argued that within the framework of new-economic development, the information cycle serves as a catalyst for social development and is its root cause.

The commercialization of scientific information implemented in the means of production that alter the content, nature, conditions and functions of labor presupposes significant shifts in production technologies (technological cycle), which is impossible without innovative transformations (innovation cycle), supported by the free movement of capital (investment cycle).

These processes can be considered as internal factors of new-economic development, which influence the increase in the efficiency of material production manifested in the enhanced labor and capital productivity, reduced production time and value engineering.

The nonlinear nature of such changes largely determines the course of structural shifts (structural cycle) involving a gradual transfer of the best customized business environment from one industry to another, from one territorial unit to another.

Such structural shifts determine a path for the development of an individual, who is a representative of labor force, requiring them to generate new knowledge and develop new working skills and capacities necessary for successful performance in all areas of activity changing under the influence of informatization. Based on this, it can be argued that new-economic development is characterized by cyclicity as an objective form of development of socio-economic systems and their components.

Recognition of the cyclical nature of innovative development implies the following. First, it manifests periodic behavior determined by the length of time; secondly, the succession of states (phases); third, the presence of close recurrent links between information, technological, innovation, structural, investment, production, and social cycles.

The above-mentioned recurrent dependencies between the cycles that form the distinctive features of the current transition period made it possible to single out the information cycle as an independent type, determine the dual nature

of the social cycle, and build up causal relationships between its components. Thus, information, technological, and innovation cycles define (form) the overall macro-cycle, while the structural and social cycles determine the resultant ones.

These conclusions can become the basis for the systematization of indicators reflecting the cause-and-effect relationships of processes occurring within the production cycle of new-economic development. The quantification of the information cycle can become a basis for determining its time boundaries and duration.

At the present stage, there is no unanimity among researchers in identifying indicators that characterize the dynamics of the information cycle, which can be explained by the essential nature of information, its immateriality and, as a result, it being difficult to measure in physical units. However, its ability to materialize itself in all the components of the system of society's productive forces (means of labor, subjects of labor, and labor force), primarily in machines and production technologies, makes it possible to systematize its indicators.

Obviously, among such indicators, quantitative and qualitative indicators of scientific knowledge should be of priority importance. We believe that they have an accumulative nature associated with the development of the information environment at each stage of the transition period in social development. At the same time, material production generates and appropriates social knowledge indirectly through such economic categories as costs and effects, as well as technological concepts like new production technologies that form the basis for changes in labor productivity, capital productivity and production costs.

Based on these statements, as well as taking into account the very nature of information as a factor of production, it seems to us that quantitative analysis within the current information cycle can be carried out in two directions. The first of them focuses on the cumulative characteristics of the information environment development, where research becomes a priority in all sciences, and the second one is economic, where the cost of research and the benefits of its implementation come to the fore.

Table 2 systematizes the information cycle indicators and presents their phase-by-phase characteristics.

The classification is based on interphase recurrence as an objective dependence of the course of each phase on the previous one and the emergence of prerequisites for the next one. In other words, we have determined the basic directions of the indicator dynamics in each of the four phases of the classical economic cycle (expansion, peak, contraction, and trough) on the basis of the consolidated and summarized findings of the modern theory and practice of managing macroeconomic cyclical processes.

The proposed indicators are conditionally divided into two groups. The first group includes cumulative indicators reflecting the development of the information environment at the current transition stage of economic and social development, while the second group encompasses economic indicators that allow us to compare the costs and effects of harnessing information.

This systematization of indicators can be used to assess the current level of the informatization of multilevel systems. At the same time, the proposed methodology for the analysis provides for the integrated approach to the analysis, objectivity and accessibility of the statistical base in use, available in the official statistical yearbooks, and also the use of a process

Table 2

Phase-by-phase characteristics of indicators of the modern information cycle in the framework of neoeconomic development

Indicators	Phase characteristic
I group of indicators characterizing the cumulative characteristics of the information environment	
– Use of information and communication technologies in organizations, in% of the total number of those surveyed; – Number of personal computers in organizations, thousand pcs; – Number of organizations with a website, in % of the total number of surveyed organizations; – Number of households with personal computers, Internet access (based on sample survey materials), in %; – Use of the Internet by the population; – Number of organizations that carried out research and development; – Number of personnel engaged in research and development, thousand people; – Number of advanced manufacturing technologies developed; – Number of advanced manufacturing technologies used; – Innovative activity of organizations, the proportion of organizations that carried out innovations in the total number of surveyed organizations, %; – Volume of innovative goods, works, services of organizations, USD million.	Crisis – consistently low; Depression – an uneven increase while maintaining negative trends; Revitalization – an uneven increase while maintaining positive trends; Lifting – increasing steadily
II group of indicators characterizing the costs and effects of the development of information	
– The volume of expenses of organizations on information and communication technologies by type, USD million; – Amount of funding for science from the federal budget, USD million; – Volume of internal expenses for research and development, USD million; – The cost of the subject of the agreement when trading technologies with foreign countries, USD million; – Cost of technological innovation, USD million.	Crisis – consistently low; Depression – an uneven increase while maintaining negative trends; Revitalization – an uneven increase while maintaining positive trends; Lifting – increasing steadily

Source: prepared by the authors

approach that allows us to view the informatization of the economy and social production as a dynamic process.

Of particular interest from the point of view of research on the recurrent dependencies of the information cycle within the current transition period of economic and social development are indicators that reflect the characteristics of the technological cycle (the number of advanced production technologies available and the number of advanced production technologies in use) and the innovation cycle (innovative activity of organizations and the amount of innovative goods, work, and services produced by organizations). This, undoubtedly, can become the basis for a

more detailed study of the nature of the current information cycle, as well as the nature of its recurrent links with innovation, technological, and production cycles.

We believe that the systematization of indicators can contribute to a more comprehensive study of the duration and parameters characterizing the current information cycle within the current transition period of social and economic development, as well as to the identification of basic contradictions and patterns of its course at each stage of its transition period.

Further, we propose a general algorithm for the analysis of cyclic processes within the current information cycle. Its main blocks are shown in Figure 1.

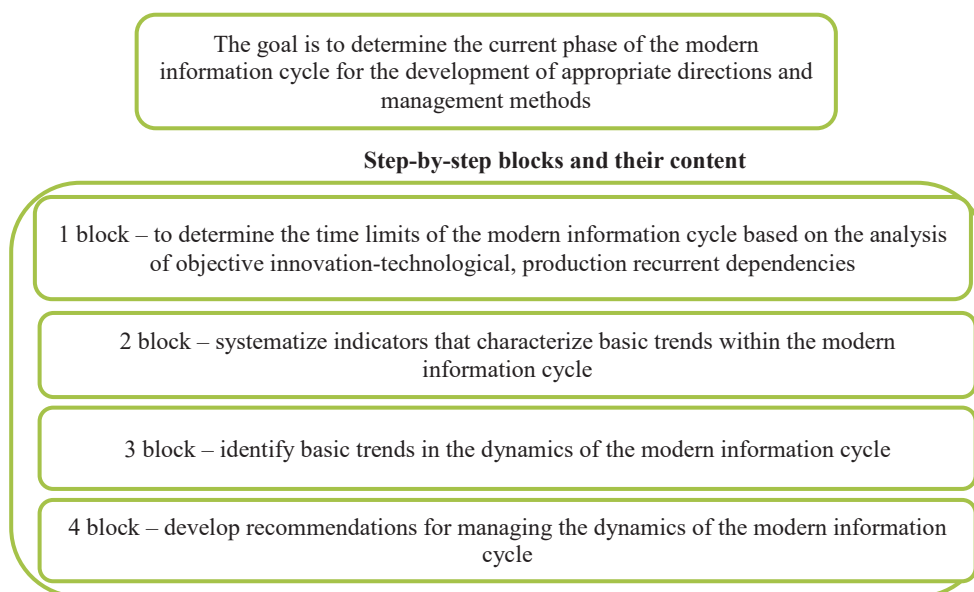


Figure 1. The general algorithm for the analysis and management of the modern information cycle

Source: prepared by the authors

The algorithm presented in the figure, despite its general nature, includes theoretical and methodological (first), analytical (second and third blocks), and management (fourth) blocks.

Particular attention should be paid to their close relationship, mediated by the subordination to a common goal which is to determine a current phase of the present information cycle in order to develop adequate areas and methods of cyclical management of interphase and inter-stage transitions within the current transition period.

The selection of the above-mentioned blocks, the specification of the goal and expected results, due to their general nature, can be specified in relation to the object and/or subject of research, which confirms the universality of the proposed algorithm, as well as its theoretical, methodological and practical significance.

Conclusions. Thus, the information cycle can be considered as an independent one within the current tran-

sition period in social and economic development from industrial to post-industrial economy. It has been proved that it determines the general vector of innovation, technological and production advancement, accumulating economic potential.

Its quantitative analysis can be carried out in two directions. The first of them focuses on the cumulative characteristics of the information environment development, where scientific research becomes a priority, and the second one is economic, where the cost of research and the benefits of its implementation come to the fore.

The identification of the peculiarities of the duration and parameters characterizing the current information cycle, as well as the basic contradictions and patterns of its course can become a basis for the development of adequate areas and methods for managing interphase and inter-stage transitions within the current transition period in economic and social development.

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