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KNOWLEDGE ECONOMY: NOOSPHERIC CONTEXT OF DEVELOPMENT

Svetlana Tumenova (a)*, Tanzilya Sozaeva (b)
*Corresponding author

(a) Institute of Informatics and Problems of Regional Management, Kabardin-Balkar Scientific Center of the Russian Academy of Sciences, 37A, I. Armand Str., Nalchik, Russia, swetasoz@mail.ru, 89287031244
(b) Kabardin-Balkar Scientific Center of the Russian Academy of Sciences,
1V, Lenin Str., Nalchik, Russia, sozaytanzilya@yandex.ru, 89280753999

Abstract

The study of the paradigm shift of development caused by formation of the knowledge economy is one of the most crucial problems of modern economics. The research subject covers basic positions of the formation of the knowledge economy as a new type of social production in the context of the noospheric concept of development. The paper analyzes the paradigmatic foundations of the knowledge economy, noospheric evolution, identification of their common factors aimed at humanization of economic growth. The study was carried out within the framework of a system-synergistic approach as an interdisciplinary research concept that includes the study of the specifics of the institutional environment, basic conditions, key factors of formation and structural relationships between the system components considering the synergistic effects arising during their joint operation. It is argued that formation of noosphere-oriented goal-setting, creation of an ethical-ecological approach to the analysis of patterns of nature-society interaction is a reasonably actual process to form the knowledge economy. It was concluded that under unprecedented aggravation of global ecological contradictions, increased restrictions imposed by homeostatic mechanisms of the biosphere, irreversible anthropogenic changes in the biosphere cannot be prevented without due account for ecological imperatives of development and rationalization of environmental management. The paper indicates the necessity to synchronize formation of new productive forces and production relations, and to achieve a consensus of interests of the society, the state, business and the individual to preserve the natural habitat as a value, a rare economic good.

Keywords: Knowledge economy, intellectual capital, environmental crisis, system-synergetic approach,

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1. Introduction

The current stage of development of the world economy and the Russian economy features an increased intellectualization of all types of activity and factors that have a direct impact on the economic growth rate. The level of development of theoretical and applied science, high-tech industries, technology market, and creative human competencies currently form the basis for formation of a new economy in which knowledge is increasingly manifesting itself as a direct productive force. In essence, knowledge is required for functioning of any society. However, the knowledge economy (KE), and speaking systematically, the knowledge society, is distinguished by the fact that the very nature of knowledge has changed. Knowledge perceived as an economic resource (production factor) and as a product (source of growth) is inexhaustible, in contrast to conventional production factors, which also strengthens its crucial role in modern reproduction process. Prevalence of scientific knowledge, moreover, ordered and reduced to a certain system, has become the main factor in making decisions in any sphere of activity. In conditions of significantly aggravated global contradictions of the current developmental stage, the issues of the mutual impact of human activity and environmental state should take a significant place in this system. These and other interdependent trends of modern economic dynamics determine the importance of KE as a complex phenomenon that emerged in the second half of the 20th century, taking into account the limitations imposed by the state of the environment.

2. Problem Statement

The knowledge economy is a transition to a qualitatively new economy, including one that does not follow the rules of classical macroeconomic theory. According to Kelly (1997), the effects of the new phenomena, processes typical of the modern economy include not so much an increased efficiency of production activities, emergence of new technologies, industries and sectors, but also transformation of the fundamental principles of economic systems. KE development requires rethinking of traditional understanding of national wealth as a sum of natural and capital resources, and a significant increase in the share of human capital in its structure. This actualizes the issue of building a new economic model to form high-quality human resources. In other words, it implies socialization of the economy ultimately aimed at reproduction of a highly intellectual personality.

At the same time, humanity, inevitably transforms nature through its productive activities and continues to conflict with natural processes. Moreover, this process is of a deterministic character, that is, changes in the natural environment inevitably change methods of production and functioning of society. Nowadays, in conditions of unprecedented aggravation of the main contradiction of modernity – the contradiction between man and the natural environment, it is becoming increasingly urgent to reduce the discrepancy between the ever-increasing human needs, the almost unlimited anthropogenic and technogenic effects on nature and the limited resources of nature itself.

Thus, within the framework of the general problem of KE formation, coordination of the goals of the development of modern society with the features of the state and development of natural systems is of particular relevance.

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3. Research Questions

The paper considers the main provisions of KE formation and transition to sustainable development of modern society based on the noospheric goal-setting paradigm, which provides for a substantial restructuring of socio-economic relations, including the development of certain procedures and mechanisms at the global community level, and requires creation of a single ecological space to preserve and develop the human civilization as a whole.

4. Purpose of the Study

The purpose of the study is to analyze the paradigm foundations of the knowledge economy, the concept of noospheric evolution, identification of their common factors aimed at humanization of the economic growth, targeted restoration and preservation of biogeocenoses as a management method based on reproducible process factors. The paper substantiates the thesis that the dynamics of the environment should be considered in models of the socio-economic system development in conditions of formation of KE as a new type of social development.

5. Research Methods

The study employed a system-synergistic approach as an interdisciplinary research concept, including the study of the specifics of the institutional environment, basic conditions, key factors of formation and structural relationships between the system components taking into account the synergistic effects arising during their coherent (joint) functioning. At the same time, the nature of current qualitative changes in economic practice associated with increased non-linearity, evolutionism and anthropologism increases the role of the post-non-classical approach and its perception of the nature of economic processes and phenomena, the content of scientific methodology, and formed ideas about its essence and structure. Within this approach, the main objects of knowledge are self-regulating human-sized systems, which, in contrast to non-classical systems, are characterized by super-complexity, instability and stochasticity (Tumenova, 2017). In these systems, the focus is on value-target activities since a person sees himself as its component with no claim to absolute leadership. As a result, the value, cultural, social and other characteristics of the cognizing subject should be included into the object sphere of economic knowledge, and new scientific areas of fundamental economic theory related to expansion of its subject space and changes in methodology (evolutionary economics, economic synergy, noospheric ecology, etc.) should emerge. In the applied aspect, this necessitates consideration of the economy not only as a production mode, interaction of economic agents or an economic (market) structure, but as a complex human-sized system in which a person as a cosmo-biosocial being acts consciously, subconsciously and unconsciously.

6. Findings

The fundamentals of the knowledge economy formation are related to the concept of Shumpeter (1952), who considered the economic dynamics and highlighted such important categories as "innovations", "improvements" and "entrepreneurship". These concepts in his theory play no less important role than

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"price", "free competition", etc. In his work Theory of Economic Development, Schumpeter viewed innovation as a means to make a profit for an entrepreneur. In his opinion, a dynamic (active, hardworking) entrepreneur (people who conceive and implement innovations) invents new combinations of production factors to have a source of entrepreneurial profits. Thus, the author considers an entrepreneur-innovator the driving force of economic progress. "Competition is driven by entrepreneurial innovations aspirations (competition of new products, new forms of organization, etc.). To survive in a competitive environment, we need a monopoly, a monopolistic position in the market of the innovation organizer" (Shumpeter, 1952, p. 88).

Views towards the phenomenon of the new economy are constantly evolving. Hayek (1945) first proposed to analyze the impact of new knowledge on economic and production processes. Based on the study by Hayek, Downs (1957) developed the first classification of new knowledge. However, Machlup (1966) is considered the founder of the knowledge economy as a discipline. In his book, The Production and Distribution of Knowledge in the USA, he defines the knowledge economy as "One of the sectors of the national economy which is concerned with production, processing and management of knowledge." Machlup (1966) estimated the contribution of the knowledge economy sector in 1958 was equal to slightly less than 30% in the US GNP. In this sector, he included numerous types of human activity, which he classified into five groups:

1. Education (44.1%)
2. Research and development (8.1%)
3. Mass media (television, telephone, etc.) (28.1%)
4. Information technology (6.5%)
5. Information services (13.2%) (p. 83)

Machlup (1966) reports his theoretical views on inclusion of various industries in the knowledge economy based on the following provisions: knowledge production is the process when someone learns something new, even if it is known to others. In accordance with his concept, the doctor participates in "production and distribution of knowledge" when he writes a prescription; a lawyer produces and distributes knowledge when he gives advice, etc.

The basics of the knowledge economy are schematically presented in Figure 1.

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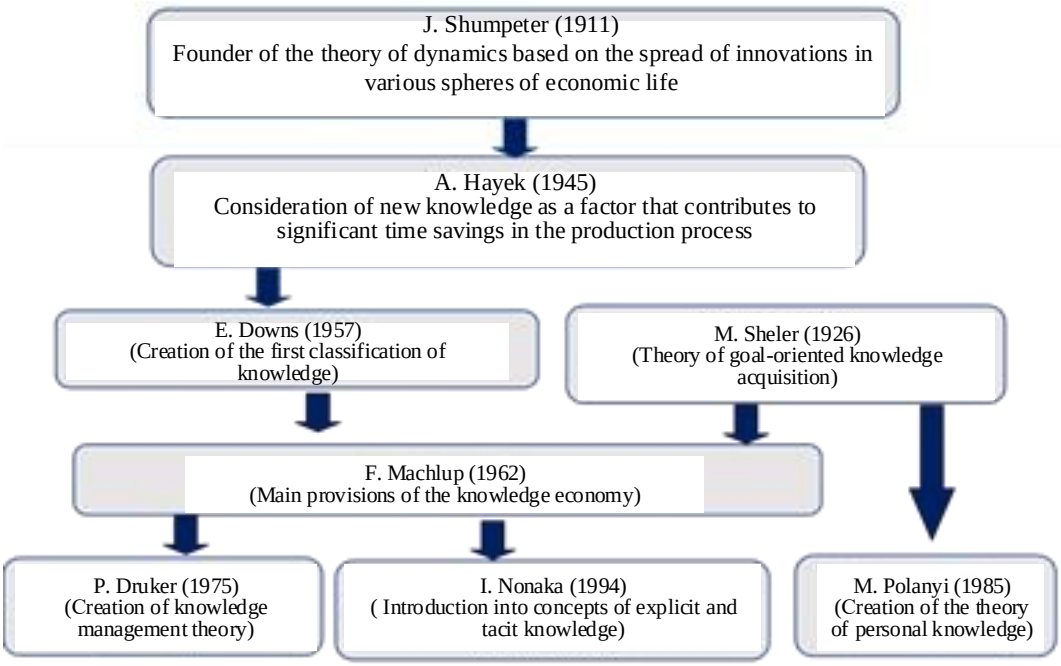

Figure 01. Basics of the Knowledge Economy

Since the 1990s, the concept of "knowledge economy" has become regarded as the main component of state policy in implementation of cross-country comparisons. When developing national strategies for individual countries, the Organization for Economic Cooperation and Development (OECD) proposed this definition of this term: "The knowledge economy is an economy that recommends its organizations and people to acquire, create, distribute and use codified and implicit knowledge to accelerate economic and social development" (Kofman, 2007, p. 131).

According to Godin (2003), the knowledge economy is an "umbrella" concept, which allows accumulation of the existing ideas and concepts in the field of science and innovations, and indicators into one conceptual system. This approach is quite problematic in terms of scientific rigor, but rather fruitful in terms of pragmatism, as it activates a huge field for new publications and discussions, and for focusing attention of politicians on new trends (Mindeli, & Pipia, 2007).

Castells (2004) highlights the main areas of changes in social life:

1. Transformation of practical activities of companies towards creation of network enterprises as specific business projects implemented through networks of different composition and origin. The network, as a non-organizational unit, becomes a type of business activity.

2. Changes in relations between the Internet and capital markets towards integration of financial markets, which ultimately turn into a kind of unified structure that functions in real time and covers the entire globe. Financing of new global venture capital projects is an example.

3. Changed role of labor and flexible employment practices in the network business model. The main factor of production is talented people – self-programmed independent labor force. Virtually everything is based on the ability to attract, retain and effectively use talented employees.

4. The specificity of innovation in the economy in the context of increasing productivity.

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Later, (Dahlman, & Pekka, 2006) developed this theme and published materials which distinguish three laws of knowledge dynamics:

- the first law is knowledge based,
- the second law is innovation based,
- the third law is based on joint benefits.

Pilipenko (2015) focuses on specifics of the knowledge economy and introduces a criterion to identify and separate it from the pre-industrial and industrial economies. This criterion is the geometric size of the natural substance involved in production of an economic product within the framework of a two-bin model of social production. The author's reproductive model (as a process of active transformation of natural resources by people to create the required material conditions for their existence) divides the factors involved in production into two main groups: Knowledge and Natural Substance. The author substantiates the possibility and expediency (due to the nature of technological processing (nanotechnology) of natural resources in 5 partially and 6 technological mode – TM) of replacing the reproduction model "Man – Natural Resources" typical of 1–4 TM, with a model "Knowledge – Natural Substance" (Table 1).

Table 01. Evolution of the structure of the economic product

Geometric size of Natural Substance involved in production of commodity	**Structure of the economic product, by factors,%**		**Correlation with:**	
	Natural Substance	**Knowledge**	**Technological mode (TM)**	**Stage of economic development**
Macrolevel (1 mm and higher)	**75** (100–75)	**25** (0–25)	1, 2 ТУ	Pre-Industrial economy
Meso-level (Tens of μm – 1 mm)	**50** (75–50)	**50** (25–50)	3, 4 ТУ	Industrial economy
Microlevel (μm – rens of μm)	**25** (50–25)	**75** (50–75)	5 ТУ	Post-industrial economy
Nanolevel (1 nm – 1 μm)	**5** (25–5)	**95** (75–100)	6 ТУ	Knowledge economy

According to the author, the changed size of the natural substance used in production of economic goods transforms the socio-economic system (SES). Moreover, the more significant the change in the geometric size of the natural substance, the more significant the changes in SES. Thus, "....when changes occur within the size range (column 1, Table 01), the economic system evolves, movement from one range to another causes revolution that requires breaking the old and creating completely new socio-economic conditions, institutions and tools" (Pilipenko, 2015, p. 56).

Since bio- and nanotechnologies do not arise from metal and machine processing technologies but completely replace them, adequate changes are required in the economic systems to ensure their implementation. Therefore, economics, as a sphere of social activity, is responsible for development of the system of social relations required for processing natural substance at a technically and technologically level accessible for society. This accessibility can be ensured only as a result of effective use of knowledge available to the society and the individual. Based on this thesis, the author defines KE as not "the economy that produces knowledge," but as "the economy that produces products which mainly (more than 3/4) consist of knowledge". The knowledge economy arises when and where the society switches over to production of goods which less than one quarter consist of natural substance. Or: KE arises where and when the society switches over to technology of processing natural substance at the nanoscale.

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At the same time, it should be noted that nanoindustrialization is not the only possible form but one of the priority directions of economic development. That is, it is reasonable to speak both about the dynamics in the development of progressive forms of productive forces, and about changes in production relations. There is no doubt that knowledge can become the main driving force of social production only in case of a dramatically reduced share and role of physical and routine work, mass informatization and intellectualization of social life, which becomes characteristic of the current stage of development of the socio-economic system of humanity (Tumenova, Ivanikov, & Rumin, 2018).

The establishment of KE implies an information (network) economy model that the post-industrial economy initially based on prevalence of the service sector and transnational outsourcing of industrial production was evolutionary replaced by the information (network) economy as a result of rapid development of information and communication technologies (ITC). An increased use of ICT and reduced strategic importance led to ICT integration in the form of the infrastructural basis of the new technological mode, thereby indicating the key importance of intelligence and creative competences (human capital) and transition to a new economy based mainly on knowledge-intensive activities (innovation, intellectual economy). However, the Internet technologies created a fundamentally new technological environment to provide flexibility and transformation of intellectual property, to expand the scope of creative work, the priority of intangible assets, and the possibility of lifelong learning, to strengthen the status and role of science, and to consolidate the key positions of high-tech business and the knowledge-intensive sector. Based on the above, KE is a concrete historical form of development of the post-industrial economy, which shows a structural shift towards an increased share and role of knowledge-intensive and creative industries in the country's GDP structure.

Thus, the development of an economic basis is insufficient to study the problems of KE formation. However, the emphasis on the social (institutional) aspect of its formation is important, since knowledge is highly associated with human activity. Knowledge as a social phenomenon arises only in the developed institutional environment. In other words, special attention should be paid to the study of KE in terms of changes not only in the technological basis of the economic system, but also in the internal laws and basic features of KE as a new way of economic management. The essential basis of KE includes the whole range of economic relations in terms of the most efficient production, distribution and use of available intellectual resources to increase the economic potential of the country that ensures the economic growth necessary for improvement of the social and personal well-being.

The specifics of the knowledge economy as a systemic phenomenon is related to:

– innovative nature of the development of the economy and its globalization;

– breakthrough in the field of information and other new technologies;

– formation of the institutional (including value, moral, ethical, socio-ecological) basis for the knowledge economy;

– cognitive management as a set of new technologies to control human capital;

– a new form of interaction between participants of the market exchange, when the consumer of knowledge participates in its creation;

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– humanization of the economic growth (transition to a sustainable noospheric type of development to provide targeted recovery and preservation of biogeocenoses as a way of economic management based on exclusively reproducible factors) (Fig. 2).

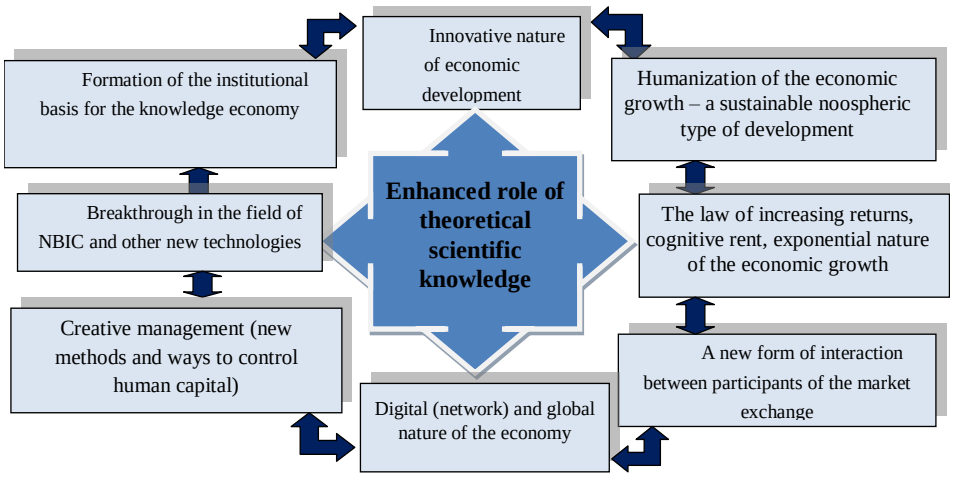

Figure 02. Specifics of the knowledge economy as a systemic phenomenon

The current significance and distinction of the identified characteristics of KE are steadily increasing. Due to the acute global ecological contradictions and the increasing restrictions imposed by the homeostatic mechanisms of the biosphere, the environmental aspect becomes one of the key issues. The environmental imperatives of development and rationalization of nature management are crucial to prevent irreversible anthropogenic changes in the biosphere.

Thus, in modern conditions an expanded reproduction of intellectual capital and harmonization of the mutual influence of man and nature become the key factor of a new quality of economic growth and socio-economic development.

The relevance of minimization of the negative effects and stabilization of the state of the environment is widely discussed in modern literature (Vernadsky, 2007; Moiseev, 1990; Ursul, 2015; Subetto, 2015; Kaznacheev, Kiselnikov, & Mingazov, 2005; Buryak, 2014; Krasnoshchekov, Rosenberg, Gelashvili, & Tomilovskaya, 2011; Velichko, Efimov, & Imanov, 2012; Burak, 2018). The principle of the unity of Nature and Society goes back to the thinkers of the ancient world. Since then, scientists argue about the place of man in the eternal and infinite nature, put forward hypotheses, and give various scenarios to predict the prospects for further development of society.

One of the possible relationships between Man and Nature is considered in the concept of the noosphere formulated in the early 20s of the twentieth century (Vernadsky, 2007). The concept laid the scientific and methodological foundations for the theory of the current stage of the biosphere evolution. According to Vernadsky (2007), the noosphere is a single process of co-evolution (joint evolution) of living matter and the biosphere on the geological, sociohistorical and cosmic space-time scale governed by scientific and organized activity of mankind. He reported an exceptional importance of preserving the biosphere balance due to the fact that the biosphere gave rise to rational human activity. To date, human economic activity is becoming a powerful geological factor that affects the formation of the biosphere.

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Moiseev (1990) developed the ideas of harmonization of the interaction between Nature and Society, and environmental management. The concept of "noosphere" is interpreted as a combination of rational human activities and the results of rational conscious techno-scientific activity on a planetary scale. Based on the logical formula of the noospheric concept "Man is the servant of Nature", the author argues that the principle of homeostasis or reasonable human behavior in the environment based on scientific knowledge and compliance with the laws of nature should be based on harmonization of relations between nature and society. The purpose of Man is to be the "brain" of the mega-system "biosphere–man" (Moiseev, 1990). In other words, the noospheric approach implies the need to coordinate all the concrete actions of Man with the natural laws, according to which the biosphere has been developing and will develop in the future. Man can create his own laws, but not the laws of Nature. He can only learn them and follow them. Inconsistency of these laws will ultimately lead to dire consequences (Naumov, 2002).

At present, the biosphere is experiencing overloads of anthropogenic character and becoming a less stable integrated megasystem. A greater responsibility falls on Man, since anthropogenic activities continue to accelerate the processes of degradation of ecosystems and contribute to strengthening of the biosphere imbalance. Today, the earth's surface area of 120 square kilometers is being concreted/asphalted every week all over the world (Smil, 2003).

The exponential growth of scientific knowledge, information, greening of environmental management, intellectualization of production activities, the latest technologies, including data on evolution of the brain during anthropogenesis, are prerequisites for formation of the noosphere based on the development of the knowledge economy. Creation of a realistic picture of megasystems (biosphere, noosphere) is possible owing to natural scientific knowledge and innovative interdisciplinary and transdisciplinary methodological approaches.

The formation of a noosphere-oriented world-view and the creation of a new ethical-ecological approach to the study of patterns of interaction between nature and society are objectively actual processes to create the economy based on knowledge. Noosphere thinking contributes to optimization of the integration process of objective ideas about nature, understanding the dynamics of social processes, and the study of man and characteristics of high-tech knowledge production in the context of socio-cultural evolution. Formation of a fundamentally new socio-natural attitude of man to the environment as a value, arare economic good becomes an important stage in understanding the noospheric reality.

Prospects for socio-economic development of modern society are directly related to the potential of Man to reduce and subsequently overcome the gap between his subjective economic intelligence, growing needs and objective harmony of natural dynamics. The gap can be overcome through formation of the noospheric type of reproduction and thinking aimed to identify and use methods for rational economic management. In accordance with the noospheric type of thinking, Man should not only preserve the biosphere in all its diversity, but also ensure the spiritual growth of mankind, humanize interpersonal and inter-ethnic relations, and preserve and develop the cultural and ethnic diversity of the world.

Thus, transition to sustainable development of the economy based on the noospheric paradigm of goal-setting requires formation of a single socio-natural space and a new ethical-ecological type of thinking.

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7. Conclusion

In conditions of knowledge economy formation, a new model of socioeconomic dynamics is of current relevance due to the need to synchronize the formation of new productive forces and production relations, and to achieve a consensus of the interests of society, the state, business and the individual to preserve the natural habitat as a value, a rare economic good.

To date, the reproduction of human capital is subject to rapid and irreversible changes associated with the formation of the economy of intellectual (creative) consumption, the process of individualization of demand and, hence, supply. Theories and concepts based on well-established paradigms of perception of society and business become ineffective.

In conditions of global ecological contradictions and increased restrictions imposed by the homeostatic mechanisms of the biosphere, the environmental aspect becomes important. The environmental imperatives of development and rationalization of nature management are crucial to prevent irreversible anthropogenic changes in the biosphere.

The formation of a noosphere-oriented world-view and the creation of a new ethical-ecological approach to the study of patterns of interaction between nature and society are objectively actual processes to create the economy based on knowledge. Noosphere thinking contributes to optimization of the integration process of objective ideas about nature, understanding the dynamics of social processes, and the study of man and characteristics of high-tech knowledge production in the context of socio-cultural evolution. The formation of a fundamentally new socio-natural attitude of man to the environment as a value and rare economic good becomes an important stage in understanding the noospheric reality.

In modeling of the dynamics of modern economic systems characterized by supercomplexity, instability and stochasticity, the study of internal mechanisms of self-organization and the search for control parameters to optimize their functioning is not sufficient. Modeling of external communications, identification and understanding of the manifestations of non-linear effects as post-non-classical systems, and regulation of the processes of harmonization of economic activity with the state and development of the natural environment are of crucial importance.

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