

Principles of convergence and synergy of the system of intellectual support of sustainable development

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Abstract: *The features of realization of the principles of convergence and synergy of components of the system of intellectual support of sustainable development of societies are considered. Characteristic features of post-industrialism, which does not act as an alternative to industrial-market civilization, are shown. The approach to increasing the level of intellectual potential in the functioning of society is proposed. This approach based on the development of cluster structures of the scientific-educational-production complex, which provide synergistic effects due to the integration of intellectual resources that contribute to the creation of new-generation innovations.*

KEYWORDS: POST-INDUSTRIAL ECONOMY, KNOWLEDGE ECONOMY, INTELLECTUAL SUPPORT OF INNOVATION ACTIVITY, SYNERGY AND CONVERGENCE OF COMPONENTS, CLUSTER STRUCTURES OF INNOVATIVE DEVELOPMENT

1. Introduction

The current stage of economic development, positioned as "post-industrial development", is characterized by a permanent increase in the role of knowledge in economic activity, both of individual business entities and regional, state and interstate complexes. The non-alternative innovative strategy of post-industrial development is based on the comprehensive use of the intellectual factor in all spheres of economic and socio-political activity. "Innovate or die" – is the main postulate of improving the economic activity of industrial enterprises of various forms of ownership, departmental subordination and functional purpose.

Modern researchers define the post-industrial economy as the "knowledge economy" ("information economy"), emphasizing the decisive role of products of intellectual activity in various forms of manifestation (knowledge) in sustainable development in the near and long term.

The driving forces of the modern economy differ significantly from the traditional factors of the development of the industrial economy. In the current economy, sustainable growth and development of economic systems takes place taking into account the predominant use of the following factors and processes [1–5]:

- 1) knowledge and processed information representing intellectual capital, which have become a strategic factor in development;
- 2) changes in the development strategy of a business entity and continuous dynamic and multifactorial processes create uncertainty and increase risks, but are a necessary condition for progressive development;
- 3) globalization, manifested in new mechanisms and concepts for the creation of scientific and technical developments, technologies, production, systems of investment, trade, communication and information interactions, has led to the development of special economic systems, the formation of global hypercompetition and interdependence of businesses;
- 4) communication development, which characterizes the company's ability to receive, process and transmit reliable information to the internal and external environment adequately to its goals and objectives;
- 5) A special role is played by the system of increasing the intellectual potential of members of societies, including high-level scientific research, professional training and social education of the individual.

The noted features of the modern economy, characterized as post-industrial, testify to the transformation of traditional approaches to the activities of the subject of industrial production in all its aspects – production, technological, administrative, managerial, etc., with a significant increase in the role of intellectual capital and the system of its formation, development and practical implementation in new types of commodity products and requires the development of new ones methodological approaches to its implementation in economic activity.

2. Results and discussion

In accordance with the theory of multi-structured economic development, the strategy of economic activity of socio-political

systems that determine the trends in the functioning of global production complexes in the post-industrial economy is based on innovative technologies in all spheres of activity with their expressed adaptation to the basic principles of the Concept of Sustainable Development [1].

Modern researchers characterize the economic system within the framework of the fifth and sixth technological modes by the basic principles of the concept of post-industrialization, interpreted according to Vodopyanov P.A. in "... as the highest stage of evolution of modern Western civilization ..." The implementation of this concept at all levels of the functioning of societies presupposes "... transition from market principles to post-economic values and active social change of previous methods and forms of labor, to the maximum use of the creative potential of workers, the formation of a new type of family and new forms of social partnership, increasing the role of scientific knowledge and changing the education system..." [3, 4].

Rudensky O.V. and Rybak O.P. believe that in the era of post-industrial development "... a fundamentally new format for the technological restructuring of the world economy is being set." According to researchers of the leading industrially developed countries, who form the basis of trends in world economic development, post-industrial development will be carried out within the framework of fundamental (basic, global) technologies – "... a system of converged NBIC technologies that determine the main directions of progress in science and technology at the present stage of social development" [5].

Earlier, it was noted that it was necessary to form innovative receptivity of both individual participants in production, research, educational, managerial and other processes that determine the trends in the functioning of the technosphere, and socio-political systems of various levels in all aspects of their life. infrastructure that adequately responds to the processes of economic, socio-political, technological, scientific, administrative, and regulatory legal functioning at the subjective, regional, state, and supranational levels [6, 7].

The real embodiment of the concept of post-industrialism and its modifications – "knowledge economy", "innovation economy", "super-industrialism", "post-Fordism", "new economy", "information revolution", "information society", etc. – did not lead to the achievement of the declared results, first of all, in the social sphere, the effectiveness of the functioning of which is traditionally evaluated by the real benefits provided to the individual, with the unconditionally comprehensive effect of normative legal norms on the regional, state and supranational levels, regulating its relations with aspects of societies.

As P.A. Vodopyanov and Ch. S. Kirvel rightly noted, "... today's post-industrialism does not act as a humanistic alternative to industrial-market civilization, but leads to new, even more severe challenges to nature and culture..." [3].

The analysis of literary sources devoted to the problems of implementing the Concept of Sustainable Development with a pronounced innovative strategy for the functioning of economic and social systems at various levels indicates the increasing role of

intellectual support for the process of development of the technosphere and sociosphere in the formation of harmonious interaction with the environment (ecosphere), the global task of which is the creative behavior of individuals at all stages life cycle. The statements of M. Leontiev are fair that "... *overcoming the crisis... involves the search for a new socio-economic paradigm, which should be based on moral principles*" and "... *Economic growth and production cannot be perceived as an end in themselves for the development of society. Priorities can be personal growth..., human communication, consumption of cultural products*" [8].

In this regard, the development of a methodology for intellectual support of innovative industries should include not only the development of basic knowledge and competencies of specialists who ensure the functioning of a business entity, but also permanent personal improvement, taking into account the concept of noosphere development developed by P.G. Nikitenko, with the dominance of the "ecological imperative" in various manifestations of professional activity and social behavior.

The prospect of sustainable development of the socio-economic complex of Belarus is associated with the formation of cluster-type production and technological complexes, the concept of which is stipulated by the adopted Resolution of the Council of Ministers [9, 10].

In the practical implementation of this Concept, it is necessary to take into account not only the realities of the scientific, technological, resource, personnel and organizational potential that has developed in the Republic, but also modern trends in innovative development based on noospheric approaches to harmonizing the interaction of the technosphere, ecosphere and sociosphere.

Studies devoted to the cluster development of the domestic economy mainly consider traditional approaches to the formation of production and technological complexes using linear models for summing up the potential of research, production, and management components combined into a cluster structure.

With the undoubted effectiveness of such an approach, based on the theory of clusters developed by M. Porter, and its modifications, it is necessary to recognize its incomplete compliance with the modern principles of convergence and synergy of basic (fundamental) technologies (NBIC-technologies), which, as noted above, determine the fundamental possibility and prospects for the functioning of economic and socio-political systems in the near and distant future. At the same time, Rudensky O.V. and Rybak O.P., it is assumed that "... *Technology convergence opportunities... will make it possible to change not only the physiological, but also the spiritual essence of a person, his thinking and mind, ... to change the very nature of man*" [5].

The principles of convergence and synergy in the basic (global) technologies of innovative development of economic systems should, in our opinion, be provided by adequate technologies of intellectual support, which are not only converging (converging) at the level of their individual components (research, educational, managerial, production, administrative), but also provide a non-additive effect from their synergistic interaction.

The intellectual resource of the cluster should have the necessary potential not only for assimilation of the components of the information field in various forms of manifestation (databases, technologies for processing, storing, exchanging and selling information), but also for development by generating knowledge of a new level for the creation of innovations and their practical implementation. The convergence of the components of the innovation cluster contributes to the formation of integrated intellectual support for innovative activities.

Our research in the field of methodology of intellectual support for innovative activities of industrial entities allowed us to propose an integration model for the formation of intellectual support for a cluster structure, including scientific, educational and production components, at all stages of the product life cycle. Such an approach, in our opinion, contributes to the practical implementation of innovative activities in accordance with the State Strategy for Sustainable Development in the implementation of cluster principles of infrastructure functioning.

In the integration model of intellectual support, there is a formal and informal convergence (convergence) of the basic components of the scientific, educational and production cluster – the Academy of Sciences (AS), the Higher Educational Institution (HEI) and the Innovative Enterprise (IE) with the formation of joint innovation units – scientific and educational (SEC), research and production (RPC) and educational and production complexes (EPC), in which the aggregate intellectual potential and material, technical, technological, instrumental, research resources of the AS, IE, HEI.

The convergent cluster structure of the highest level is the Scientific, Educational and Production Complex (SEPC), which is capable of implementing a synergistic effect due not only to the generalization of material intellectual resources, but also to their percolation (from the latin *Percolatio* – filtration) in the volume of the innovation cluster.

The fact of the presence (construction) of an innovation infrastructure using modern technologies and means is a necessary, but not sufficient condition for its functioning and progressive development with the production of innovative products with a growing number of consumer characteristics.

An innovation structure, including the cluster type, should have a permanently renewable resource that extracts from its components (material, technical, informational, technological, managerial, research, etc.) the creative component, which is the basis of innovations – knowledge and competencies of a new level and content. Such a percolation resource is an integrated intellectual resource that includes basic and variable components. Therefore, the cluster innovation structure should provide conditions for the permanent development and improvement of the variable (labile) component of the intellectual resource using the achievements of converged technologies, primarily NBIC technologies.

The principle of percolation (filtration) of intellectual resources ensures the formation of a single matrix field, in which high-level intellectual resources are located, capable of forming innovative products (goods, technologies and services) on the basis of the creative application of basic (stable) and labile (acquired) knowledge, which are a prerequisite for innovative development and the result (intellectual product) of scientific activity, which, as noted by Rudensky O.V. and Rybak O.P. "... is dominant of basic and converged technologies" [5].

The synergistic effect of the process of percolation ("filtration") of intellectual resources in the cluster structure consists both in the adaptation of the developed innovations and educational programs to the resources of the existing industrial component (innovative development of traditional technologies), and in targeted research and professional training in the scientific and educational components for the development and application of innovations of a new generation (the creation of innovative, including "high-tech") technologies). Convergence (convergence with interpenetration) of the resources of the basic components of the cluster structure (AS, HEI, IE) – intellectual, material, technical, technological, informational – ensures the formation of creative thinking of participants in the innovation process while destroying stereotypes due to the traditional educational paradigm.

It is especially necessary to emphasize the characteristic feature of the process of percolation of intellectual potential in the infrastructure of the integration cluster, which consists in changing the educational paradigm in the training of specialists with traditional (routine) thinking, to the training of specialists with basic competencies that meet the requirements of the sustainable development strategy. At the same time, it is possible to form practical skills of cognitive thinking among specialists, which are not given due attention in the current educational code.

The educational paradigm operating in the CIS (Commonwealth of Independent States), formed on the basis of traditional (routine) methodological approaches without taking into account modern trends and prospects for the development of post-industrial societies, trains mainly a "consumer specialist", and not a "creator specialist". The approximation of the educational concept to foreign standards actually ensures the adaptation of individuals from various socio-political systems differing in the level of technological development

to the current paradigm of economic and socio-political development and the system of characteristic values (cultural, religious, moral) of the leading powers by suppressing and transforming the basic distinguishing features formed by national, cultural, educational and other traditions with the subsequent consolidation of the imposed stereotype in behavior and thinking through subsequent permanent training (retraining) in the employer's own interests. An individual reformatted in this way, even with progressive and high competencies, is not able to fully adapt to another socio-political and economic system that does not have similar signs of a technological, administrative, regulatory legal structure and the level of material support for a comfortable and safe life.

3. Conclusion

In the post-industrial economy, the percolation interaction of the components of the integration cluster, manifested in the joint use and activation of intellectual resources belonging to each component, contributes to their convergence and provides a synergistic effect in solving the aggregate problem of achieving optimal economic benefits with the adequate development of corporate culture, creative thinking and innovative receptivity of all members of the structure through the implementation of the process of permanent cognitive learning using advanced achievements in the sustainable development of the post-industrial economy at the subjective, regional and global levels, taking into account the synergy and convergence of priority (global) NBIC technologies.

4. References

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