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Concept of "Scientific Revolutions" in Nature and Society Knowledge-Based Systems

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Abstract: The article discusses the situation that has developed in fundamental science and education applied to the sphere of information technologies. The author considers the terms "concept", "paradigm", "noosphere", etc. in the context of the definitions of E. Le Roy, P. T. de Chardin (1927), V. I. Vernadsky (1933), T. Kuhn (1962), T. Stonier (1987) and modern philosophy.

The purpose and main aspect of the outcome is the development (or support) of the plan's "man-machine" system for making the best management decisions. (ASDM) for all - global, regional, local - levels of strategic management of Nature and the Society. Object of research is Active Complexly Organised Systems (ACS) of "Nature <=> Society" class; subject - concepts of "balance" and "sustainable development" (CSD in UN abbreviation, 1993). Research methods: NBIKS, GIS-, GRID-, Blockchain technologies; BIGdata, neural networks, Artificial Intelligence Systems (AI), Self-Learning Systems (SOMS), Virtual Models (VIM); games with non-zero-sum.

T. In Kun's "Scientific Revolution" concept, the result of the research is that all knowledge around us ("mechanical" thinking) requires a strategic transformation from their complete integration ("nusphyric" thought).

Keywords: paradigm, theory, concept, science, information

INTRODUCTION

The methodological basis of the «scientific revolutions» concept are the words of the great thinker of the past Russia - A.I. Herzen. "Conservatism, which has no other purpose than the terrifying status quo, is just as destructive as revolution. It destroys the old order not with the fire of anger, but with the slow fire of insanity" (cit. ex: [4, p. 3]).

The term "paradigm" defining the concept is further considered in the author's definitions of the original model of new scientific knowledge (T. Kuhn, 1962), i.e., in the form of "... a general mechanism for the development of science as an integral unity of "normal science" and "non-cumulative leaps" (scientific revolutions)" [9, p. 197]. In the appendix to the sphere of information technology, the following definitions of this term are most important: "... a set of methodological and theoretical prerequisites that define a specific scientific research..."; "... a method of setting problems and research methods dominating in science of a certain historical period"; "... the basis for choosing problems, as well as a model for the tasks solution" [14, p. 354].

It is known that in the appendix to different historical development periods and spheres of Society's life and activity, all its reasonable practice, related to the external forces of Nature, one way or another is reduced to the function "management" and definition of the term "information" ("synergetics" and dynamic theory of information [16]). So, according to A.A. Lyapunov (60th years of XX century): "Management based on transfer of information is an integral part of all life activities, moreover, management can be declared a characteristic property of life in the broad sense" [5]. Moreover, if we consider the global level of our being, then the common goal and result of the development of all the matter around us (or "noosferogenesis", N. Moiseev, 1982) is the consistent "binding" of the free entropy of the Universe into its organized and demanded forms today and in the future by man [17]. Therefore, the purpose of basic science, in a broad sense, is defined by the following statement of PT D Chardin: "... It is believed that the world is not just a register, but a form of unity that, if not thought, is deprived.

It is known from epistemology and social practice that science cannot develop successfully without regular methodological rethinking of its fundamental foundations. This fact acquires special sense and urgency in some critical moments of civilization development when there is a natural change of initial scientific paradigms and ways of system representation of the world around it.

Today, in the science of the earth and society, we observe this process, because from the beginning of the new century, a fundamental revision of the old norm (known as the xyii century) and a new natural science knowledge and ideal - "nusphyric" thought means and logic of this kind of transformation (mathematically its requirements (14, 133; 438). "In the present ideal... There is no place for consciousness, emotion, thought or soul. ... And that means there must be a paradigm shift that will enable the consciousness to be included in our world view. The universe we created must now expand beyond what we have. (W. Tiller; CIT, Ex: [1, p.59].

METHODS

Modern fundamental science owes its relative completeness to the known laws of mechanics and, in particular, to the work "Mathematical Principles of Natural Philosophy" by I. Newton (1687). In 1865 these achievements were generalized by R. Clausius (the term "entropy") and later by him and W.

Thomson and L. Boltzmann, complemented by the well-known laws of thermodynamics. Taken together, these studies made it possible to introduce into scientific practice a "thermodynamic" paradigm (or "mechanistic" thinking; the "object-oriented" approach is used as a defining one).

In 1927, E. Le Roy, P. T. de Chardin and, later, V. I. Vernadsky formulated (in the form of a hypothesis "... about a qualitatively new form of organization arising from the interaction between nature and society, characterized by the connection of the laws of nature, thinking and socio-economic laws of social development") the theory of "noosphere". However, up to the beginning of our century it did not have (and from methodological positions could not have!) its full theoretical and experimental confirmation.

Based on the scientific success of quantum physics (field theory, UFT [8-10] Based on scientific success, it is designed more theoretically and experimentally (mathematically [2-3; 6-7), new - "Nusphyric" - Heaven,

Nowadays, the main point of our civilization is to solve the problems of sustainable economic and social development. From the time of the Gh Brundtland Commission (1967), the latter was formed and the world community adopted the concept of "Sustainable Development" (CSD), the official doctrine of government development in many countries (in 1993, three years later in the United States).

Unfortunately, today this concept is not properly understood by basic science as the new scientific model of the XXI century. Here, the most reliable proof of this is the theory of "nusphere". However, despite significant scientific efforts, it is not clear today how to implement the current practice of managing the development of the planet's organization at various levels, how to achieve its objectives, or at least evaluate its dimensions in a neutral manner.

The conclusion is clear from here. Without the systematic transformation of natural science from traditional ("mechanical") to the new "nusphyric" thinking, it is impossible to solve all the theoretical and practical problems of CSD.

As special management methods, the study used the basic principles and criteria of system thinking, the most important properties of active systems (by: F. Capra; vide: paragraphs 1-14, Appendix [12, pp. 38-40] and S.L. Turkov; paragraphs 15-16 [12, pp. 40-41]. So, with the purpose of maintenance of processes of strategic management of ACS, for us the following scientific results and methodical positions were main. 1. The principle of "equilibrium" by L. Bertalanfi ("General theory of systems", 1969): "The system can reach the same final state under different initial conditions". 2. The principle of "heterarchy" of active systems" by F. Capra, 1991; it is the basis of modern theory of informatics (development of "neural networks"): "Flexible functional hierarchical forms which are quickly created and transformed according to changing needs" (vide: p. 7 [12, p. 39]).

RESULTS AND DISCUSSIONS

From the point of view of the ACS management theory (N. Wiener, 1968; L. Bertalanfi, 1969; G. Hacken, 1980; I. Prigozhin, 1990 and others [15, 16]), the first - initial and fundamental - problem is a conscious choice of the modern scientific paradigm, within the framework of which it is supposed to study and solve all the issues of the future optimal management. Today we know two scientific paradigms: "mechanistic" and "noospheric" thinking. But it follows from synergetics and dynamic theory of information that the latter always "... is a memorable choice of one variant out of several possible and equal" [17, p. 13]. So, the choice of one of two paradigms is inevitable. Hence, if we follow epistemology when studying the fundamentals of the CSD, obviously when the initial paradigm changes, our thinking about the phenomenon under study should also change a priori [10-13].

The possible solution of this important issue for the CSD theory can be explained based on N. Bohr's "compliance" principle, 2013. It states: "... the change of one natural science theory to another reveals not only the difference, but also the connection and continuity between them, which can be expressed with mathematical precision" [14, p. 438]. Graphically, the general information meaning of this principle is presented in Fig. 1, where the old and new paradigms are conventionally designed in the form of two circles of different dimensions (they are denoted by Roman numerals I and II).

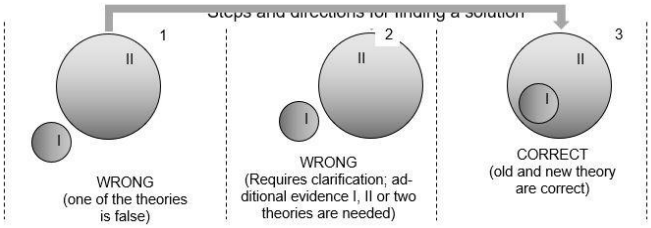

Fig.1. Variants of three possible information states of two scientific paradigms or scientific theories

It follows from the Figure that full compliance with this principle is achieved only in 3rd variant of their information states, when the main condition is mathematically ensured and fully realized: "particular" of the old paradigm or theory in relation to any "hypothetically" advanced and newly proposed form of scientific knowledge about Nature and Society.

It is known that the conceptual basis of modern "noospheric" thinking is defined both by the newest paradigm and by the next one and all other natural science knowledge, CSD. Table 1 shows the main comparative characteristics of the old ("thermodynamic") and new ("noospheric") paradigms. Its system analysis and synthesis allow us to draw the following constructive conclusion: the physical and experimental proof of UFT and "New Entropy Theory" [7] in their unity completely "cover" all the main (initial) methodological and theoretical problems of the CSD. From the standpoint of fundamental science, this theory and the new paradigm determine the process of transition from the technology of differentiation of

natural science knowledge about the world around us to their integration. At the same time, it should be especially noted that theoretically, the measure of expanding our knowledge in such a transition should grow by at least 6.8 times! (vide calculations of J. Wheeler's plank density of physical vacuum energy and nuclear substance [10, pp. 55-133]).

In the works ([11-12; 21-22], etc.) the results of Fig. 1. and Table 1 were used as inputs for the development of the "Basic Theory of Regional Environmental Management". The general scheme and technology of cognition provided for implementation of the logical scheme, which is generally accepted in fundamental science: "object" <=> "subject" => "research methods".

Active Complex Organized Systems (ACS) of the "nature <=> society" class were adopted as the initial object of research; the subject is "balance" and "sustainable development" (CSD). Its practical implementation is methodically and technologically considered in the form of a consistent transition of research logic from the descriptive to the constructive and, further, to the regulatory aspects of the interaction between Nature and the Society at all required (by input conditions) levels of global, regional and local environmental management, but with their specification.

So, based on the principle of "additionality" of N. Bohr (1913 [14, p. 133]) the following concepts were defined. For ACS, as initial "object" of control, system definition is given and the basic functional property is allocated: conflict in the conditions of uncertainty, and the general area of knowledge (specialty 25.00.36 "Geoecology"). So, "geoecology" was defined as area of knowledge about forms of existence and limits of interaction of geosphere shells (or, - on A.D. Armand, 1968, - geosystems of the highest level of the planet organization: space (or so-called "near" space), litho-, pedo-, hydro-, atmo-, bio-, anthropo- spheres).

Table 1 Main physical and information characteristics of modern paradigms of system representation of the world

Thermodynamic paradigm ("object-oriented" approach)	Noospheric paradigm ("normative" approach)
Representing nature as parts or separate resources rather than interacting processes	Connection and interdependence of all phenomena and objects of living and inanimate nature, as well as the processes occurring in it
Simple linear (3-dimensional, Euclidean) space:	Multidimensional non-linear "Space-time."
- an invariant world where a measure (coordinates and impulse) is preserved when a material point is turned and moved;	- not invariant world in which no measure (coordinates and impulse) is preserved when a material point is turned and moved;
- negative meaning of entropy, perceived as a measure of disorder and chaos;	- positive meaning of entropy when it is seen as a measure of structural perfection, as formulated in a symbolic form of the architecture of the system;
- typical “macro-” approach; at management of objects the "black box" principle is used, when only external - in relation to the system - processes are considered and studied;	- "geosystemic" ("macro-" + "micro-") approach, when both external and internal processes of functioning and development of complex systems are investigated;
- approach is fully adequate for the "conservative" systems known from synergetics;	- the approach is adequate for the prevailing in nature and society "dissipative" (i.e. far from the state of balance, self-organizing and self-developing) systems;
- provides, to a certain extent, a complete solution of tasks of "hard" (man-made) control;	- provides the solution of problems of "hard" and "soft" (restoring ecological balance) nature management;
- only deterministic and probabilistic (stochastic) setting of control tasks is possible;	- theoretically possible deterministic, probabilistic, undefined and theoretical-playful formulation of control problems;
- realization of computational operations of situational control is impossible.	- full realization of computational operations of situational control is possible.

Then, for the latter, the following formula was proposed: GP, LR (object - geosphere of the planet, object - life-supporting resources); => BS, NS (initial theories - biosphere and noosphere); → EQ, SD (goal - equilibrium and sustainable development); GL, RG, LC (management levels - global, regional, local); CU (basic property of their functioning and development - conflict in the conditions of uncertainty). According to our estimates, effective management decision-making at any level requires at least 24 separate theories, terms and new concepts, beyond which the CSD implementation is impossible in principle [12, pp. 19-20].

For the "subject" - a block of "Metaknowledge" of all natural sciences about the Earth and Society has been introduced in automated planning estimates system; they represent logically (theoretically, methodically and technologically) connected knowledge of the highest level about the object, subject, problem (task) subareas and methods of research of each of the complex of Earth sciences, the Society and natural sciences as a whole, the general target function of which is aimed at making effective managerial decisions in the process of their mutual "coevolution" (N.V. Timofeev-Ressovsky, 1968). As a result, as a full result of the research, the following target function was

proposed for all levels (global, regional, local) and functional directions of making managerial decisions: "min" losses of initial natural matter at "max" of material and social benefits [11-12].

In 2017 the project "National Sustainable Development Concept (NSDC) of Russia" [13; 21-22] was completed at the Computing Center of the FEB RAS (Khabarovsk), some results of which were reported at different times in the country and abroad. At the same time, two new (information) properties of ACS were proposed (in addition to [2]): "15. Informational complexity"; "16. “Time factor" [12, pp. 40-41]. And as the highest measure of moral evaluation of "noospheric" thinking and all results of calculation of possible variants of strategic management, 7 basic rules of confessional and cooperative behavior should serve [20]. The main methods of solving such problems: “Games with Nature” and "non-zero-sum".

CONCLUSION

The problems of "coevolution" of Nature and Society are among the global problems of our time. Their scientific solution determines the present and future state of the complexly organized systems of the "nature <=> society" class in any region, state, and planet as a whole. In practice, they are reduced to the function of "managing" "noospheric" processes. It is important that "management", in the type and form of decision making process, is one of the defining functions of human being as a "biosocial" being, because both "object" and "subject" of management participate in it simultaneously. But if at the end of XX century the most characteristic feature of the Society's development was the "information" revolution, then the beginning of our century is already determined by its "synergetic" component, when the planet and civilization enter the era of "noocracy" (or the new global society, where the power of reason and justice based on science and knowledge will prevail; NBIKS, GIS-, GRID-, AI, SOMS and "Blockchain" technologies, "Reengineering" and "Knowledge Industry" methods [19]).

REFERENCES

1. A.A., L. (1972). *What is the systematic approach to the study of real objects of complex nature?*
2. A.N., P. (1999). *Entropy.*
3. B., M. (2002). *Fractal geometry of nature. Institute of computer research.*
4. D.S., C. (2004). *Synergetics and information: Dynamic information theory.*
5. E.N., K., & S.P., K. (n.d.). *Synergetics as a New Worldview.*
6. F., C. (1991). *System control in the 90th years.*
7. Frolov., I. (1987). *Philosophical dictionary.*
8. P, J. (1987). *Expert systems.*
9. Rostov-on-Don. (1995). *Modern Philosophy.*
10. S., H. (2018). *Brief history of time: From the Big Bang to the black holes.*
11. S.L., T. (2017). *"Metaknowledge" of geoecology.*
12. Sharden, & P.T. (1987). *Human phenomenon.*
13. Sirotenko, & B.M. (1990). *About the similarity of the “micro-” and “macro-” cosm.*
14. T.S., T., & V.Y., T. (2002). *Physics of Faith.*
15. Turkov, & S.L. (2003). *Fundamentals of the regional nature management theory.*
16. Turkov, & S.L. (2018). *National concept of the National Concept Sustainable Development of Russia.*
17. W., A. (2013). *Rabbit Mountain.*
18. Y., H. (2007). *Homo ludens / Man playing.*
19. Y.I., K. (n.d.). *Natural Science and Mathematics.*