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Mining education: traditions and perspectives in the XXI century

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HUMAN, NATURE, SOCIETY: SYNERGETIC DIMENSION

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The paper gives an overview of the major directions of development in the system 'human – society – nature' and their philosophical and scientific contemplation. The fundamental achievements of the society and responsibility of the mankind for its progressive development have been analyzed. The distinctive features of changes in human interactions with nature in the era of globalization and intensive progress in science and technology are presented.

It is reported that numerous studies of human intervention in the biosphere processes prove that it can become the most profound anomaly in the development of not only the biosphere but of the entire Earth system, i.e. become a cause of such conditions on the Earth that would be alien to the general biological process in its ontological sense. The consequence of this is a dissonance in the rate of social evolution (social form of matter) and nature evolution (all pre-social forms of matter), which is translated into the disturbed 'functional optimum' of intensive development of the 'human-society-nature' system, a threat of environmental crisis and disturbances in the very biological nature of a human.

It is asserted that synergetics today still remains appealing due to a need to find adequate answers to global civilization challenges in the world living through a crisis. According to estimations, human synergetic activities come to the fore in the 21st century, it is especially true for small and large self-organizing groups, which shall not only live in harmony with the nature, but also successfully manage all different-level subsystems.

It is shown that synergetics is a new dialogue between human and nature, a new synthesis of the human knowledge and wisdom. This is a new approach to gaining insight into the evolution crises, instability and chaos, to mastering complicated systems in the state of volatility.

Key words: human, society, nature, globalization, intensity, conflict, crisis, synergetics, chaos, instability, volatility, bifurcation.

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Nature and its relationship with the society have also been among the central problems of science and philosophy. This relationship has historically changed both with evolution of the natural environment and with the development of the human and the society. In the 21st century in the era of globalization and intensive progress in science and technology it got a modern sounding. Its scientific and philosophical comprehension shall facilitate such decisions that could have an impact on the progressive development of the society and the future of the mankind.

It is known that human both historically and ontogenetically is constantly day after day interacting with nature. The great philosopher I.A.Ilyin noted that "this is the case with the landlord and the laboratory scientist, with the train guard and the artist ... Each of them interacts with the nature in his own way. Each of them learns from it, tries to adapt to it, use it for his cause, kind of to coax it. And this coaxing of the nature with attempts to listen to it, this learning from it with attempts to take control over it, this careful conquering of it and domination over it is one of the joys in life on the earth of every spiritually living person. It may so happen that the nature gives him wisdom, refines with its beauty his aesthetic feelings, sometimes punishes him and sometimes rewards him a hundredfold.' [7, p.319].

The well-known contemporary of Copernicus, Georg Bauer (Agricola) (1494-1555), after receiving education in Leipzig and the University of Bologna, was practicing medicine and social activities, but became prominent as a researcher of the lithosphere, extractable resources, mining and metallurgy. Agricola was not a philosopher, but was contemplating a lot on relationship between the nature and the society. He became a founder of the European mineralogy. 'If there is such a power of water, air and fire hidden in the Earth, it's no wonder that it gives birth to various masterpieces of nature, for there is no element nor primary quality bearing any defects. That's why the Earth has sufficiency of matter and causes for creation,' Agricola wrote in 1544 [1, p.586]. His ideas of the role of bios in the earth formation, similar to 'biogeotheory' of Leonardo Da Vinci, are of high interest and may to some extent be regarded as a prototype theory of biosphere.

Scientific achievements of the 20th century gave a possibility to take a new look at the role of human in the system 'nature-society' and in a new century. Naive anthropocentric outlook previously viewing a human as 'a tsar' of the animal world is losing its dominating position. It became especially

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evident in the end of the 20th century and beginning of the 21st century, when new interdisciplinary field of knowledge appeared, such as sociobiology, bioethics and biopolitics.

At the turn of the century the modern civilization reached such a critical milestone in the global historical process, which predetermines the dynamics and directions of civilization development in the long run. It becomes obvious that sticking to traditional stereotypes and attitudes, that do not ensure civilization's constructive functioning, jeopardizes an optimal equilibrium and stability of historical socio-natural structures. Presently the Earth is experiencing an acceleration in evolution rates. V.O.Kovalevsky was among the first who noted this, he wrote that 'each subsequent major Earth period is shorter than the previous one, and in this short time more diverse forms of life had time to come into being and become extinct than in the previous era; beginning with the Tertiary period life has been hurtling along at full speed' [8, p.67].

Numerous studies of human intervention in the biosphere processes provide rather a complete picture, that the anthropogenic process can become the most profound anomaly in the development of not only the biosphere but of the entire Earth system, i.e. become a cause of such conditions on the Earth that would be alien to the general biological process in its ontological sense. The consequence of this is a dissonance in the rate of social evolution (social form of matter) and nature evolution (all pre-social forms of matter), which is translated into the disturbed 'functional optimum' of intensive development of the 'human-society-nature' system, a threat of environmental crisis and disturbances in the very biological nature of a human. These processes led to a necessity to shift a focus of research in various fields of knowledge, such as medicine and its related sciences.

Besides it becomes impossible to ignore the fundamental changes in the minds of people associated with domination of the man-made, artificial over the natural. Back in 1950 Romano Guardini in 'The End of the Modern World' wrote, that 'the gods are no longer possible', as it is technology that is ruling the world. The conditions of man being changed so drastically, that under the threat is the most important and essential human quality – humanity and moral dignity. The challenges faced by man in the modern technogenic civilization are referred to by Guardini as 'a loss of humanity' [6].

Human synergetic activities come to the fore in the 21st century, it is especially true for small and large self-organizing groups, which shall not only live in harmony with the nature, but also successfully manage all different-level subsystems. At the same time it shall be noted that the cooperative systems themselves live by the principles and laws of dynamic systems. Due to this a number of issues emerge, which shall be carefully examined. Firstly, in considering social and psychological systems a regard shall be given to the complementarity principle of N.Bohr, the essence of which is that the researcher interacts with the object under examination, which leads to occurrence of new qualitative properties, and the object examined in the process of cognition, appears to be slightly different than before the interaction. Secondly, there is no complete formalization of the studied synergetic phenomenon.

The modern nature of research activities is changing dramatically. Conventional classical methods of research in physics, chemistry, biology, intended to discover simplest elements in order to explain how a complex whole is organized, have been replaced by other methods. Within a conventional paradigm it was believed that the development of simple and complex linear systems had no alternatives, while simply speaking there was no place for dynamic chaos, nonlinear systems, play of chance and personal choice of a certain person. New synergetic paradigm provided a different perception of the world, through a lens of its nonlinearity. Focuses in examination of structures and systems have been shifted.

Researchers started to pay more attention not to external forces, organization and management processes, but to internal ones: self-organization, self-development and self-management.

The synergetics foundation was laid by H.Haken and I.Prigozhin, the authors of synergetics, in their observations on some physical and chemical processes (autocatalytic chemical reactions, the formation of Benard cells in liquid, laser, turbulent motion of the fluid, behavior of ferromagnetic materials) in conditions of exchange with the environment [11; 15].

The authors noted that system behavior in the said processes becomes nonlinear and unstable, and as a result the system reaches a point, named the bifurcation point, at which multiple development scenarios are possible. What became essential for synergetics is that in the process of transition from one stable condition to another in the open systems the entropy is not growing, but decreasing and the new structures appear [10; 11; 15]. Based on these observations conclusions were made that these are synergetic processes that lie underneath emergence of new forms of matter, i.e. the morphogenesis. While

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authors believed that essential conditions of such processes are exchange with the environment, random nature of external or internal influences, as well as instability, nonlinearity and irreversibility.

It is obvious, that synergetics (from the Greek 'synergeia' meaning energy of cooperative or combined action), which appeared in the 20th century, is a new interdisciplinary science studying the basic laws of complex systems self-organization of complex systems. It includes such areas as nonlinear dynamics, chaos, fractals, catastrophes, bifurcation, waves, solitons, field effects, etc. There are numerous Russian and foreign publications devoted to application of synergetics to the analysis of sustainable development of nature, society and human: e.g., aspects of synergetics creation are described by B.P.Belousov, A.A.Bogdanov, L.Bertalanffy, V.I.Vernadsky, G.Gibbs, Ch.Darwin, A.M.Zhabotinsky, N.I.Kobozev, A.M.Lyapunov, K.Marks, G.Spenser, E.A.Sedov, et al.; development of synergetics – G.Nicolis, I.Prigozin, I.Stengers, H.Haken, M.Eygen, V.Ebeling, K.Mayntser, etc.; application, development and philosophical foundation of synergistic approach – V.I.Arshinov, V.P.Bransky, V.G.Budanov, V.I.Danilov-Danilyan, S.P.Kurdyumov, E.N.Knyazeva, A.P.Nazaretyan, G.G.Malinetsky, N.N.Moiseev, A.A.Samarsky, S.D.Khaytun and many other authors.

According to V.G.Budanov, it is an organic approach to view synergetics in the modern scientific culture in three aspects: synergetics as a picture of the world; synergetics as a methodology; synergetics as a science [4].

The synergetics today still remains appealing due to a need to find adequate answers to global civilization challenges in the world living through a crisis. In the opinion of Professor E.I.Stepanov, '...the present-day globalization as a general trend of bringing individuals, countries, peoples together at a planetary scale and developing their social and cultural relations is not an incidental phenomenon. There are at least two objective circumstances that historically determine the uniting processes:

• firstly, all countries and all peoples live on one planet Earth, and this territorial (geographical, spatial) commonality forces everyone to be involved to this or that extent in one way or another in finding solutions to the occurring problems common to all, i.e. global problems;

• secondly, in all the diversity of countries, peoples, ethnic cultures, despite mankind differentiation on economic, political, national, religious and other grounds – all the people are various forms of existence of universal human race' [12, 13].

Many researchers of synergetic processes note that synergetic methods are rather universal, as they have a genetic link to the 'eternal science' – the mathematics. Synergetics is methodologically open to new images and concepts, possesses a feature of continuity, i.e. correlates with its interdisciplinary predecessors – theory of systems and cybernetics, based on the correspondence principle. It is characterized by interdisciplinary tolerance to new methods and hypotheses, their intrinsic value for synergetics; self-applicability, philosophical dialogueness and reflexivity.

Synergetics of human-dimension systems today, in the era of anthropological turn, creates a special meta-level of culture, reflexive tooling to analyze its evolution – a synergetic methodology, methodology of interdisciplinary communication and simulation of reality. According to V.M.Rozin [12], this methodology is open, may be even with limited liability, adaptive, but it is not universal panmethodology in the spirit of G.P.Shchedrovitsky [16].

In the synergetics itself several coexisting layers of its being in the contemporary culture can be found, arranged by increased level of abstraction:

• the ordinary consciousness of everyday practices – under-disciplinary;

• processes of individual creativity and development of disciplinary knowledge and objects explored – disciplinary;

• processes of interdisciplinary communication and knowledge transfer in the dialogue of disciplines, pedagogy and education, in decision-making – interdisciplinary;

• processes of building, self-organization and operation of large interdisciplinary projects, interdisciplinary languages of communication, the nature of occurrence of interdisciplinary invariants, quasi-universalities, collective intelligence, network thinking – transdisciplinary;

• processes of creation and evolvement of philosophical knowledge, development of science and culture – over-disciplinary [4].

Synergetics has unique application traditions at each level. These traditions are scientifically sound and methodologically mature at disciplinary level, especially for natural sciences [3]. Application of synergetic methodology at interdisciplinary level is developing most actively [14]. Experts in this field note,

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that its applications at other levels emerged only recently and are mainly comprehended in terms of synergetic picture of the world [3].

Synergetics is a new dialogue between human and nature, a new synthesis of the human knowledge and wisdom. This is a new approach to gaining insight into the evolution crises, instability and chaos, to mastering complicated systems in the state of volatility.

Synergetics teaches how to see the world in a new way, and first of all, to understand that one cannot enforce certain development patterns for the complex structural systems, it is more reasonable to facilitate their own development trends. Second, it demonstrates how and why the chaos may be a creative power, a constructive mechanism of evolution, how new organization may spring out from the chaos using its own power. Third, synergetics provides evidence, that there are several alternative development routes for complex systems. Fourth, it opens up new principles of superposition, 'assembling' a complex evolutionary whole out of diverse components, building complex developing structures based on simple ones. Fifth, synergetics gives knowledge of how to manage complex systems in an efficient way, the core of which is not the force applied on the system (the environment), but a properly designed resonant impact, which is much more efficient. Sixth, synergetics uncovers laws and conditions of flow of rapid avalanche-like processes and processes of non-linear, self-stimulated growth.

It is known that in the late 20th century in Russia the environment for operation of business entities and social-economic structures established in previous stages of its social and economic development changed. New possibilities appeared for combining resources, the mobility of which is to a greater extent determined by the scale and the appeal of implemented economic, political, humanitarian and environmental projects, rather than by international or regional boundaries. Certainly the Russian northern areas bearing the major resources of the country did not remain outside these processes. Sights of many countries are set thereon. Thus it is no coincidence, that Russia has recently paid the closest attention to these areas, changing its strategy for northern regions development, and perhaps just reviving in a new fashion what has already been done a long while ago.

The project being developed for the future of the country as a whole and of its northern areas is getting further and further away from the customary cornerstones: local resources, location of production facilities, ideological constructs and political sympathies.

But it shall be highlighted, that the intensified processes in international relations and their transition to a new system turned out to be a daunting challenge for Russia. So far for various reasons it has not yet found its own path of economic development, and that's why in new conditions it makes attempts to get integrated into the industrially developed world, which has already begun to build its own plans for the use of mineral resources of Russia. Unfortunately, Russia, having internationalized its resources by becoming a part of other countries' projects and process flows, has not built new mechanisms for managing its own development and put itself at economic risk, while further strengthening its orientation for resources export. Perhaps the intense economic and political changes in international relations in the recent years, anti-Russian sanctions imposed by the developed western countries will make it imperative to revise the country's development strategy in virtually all spheres.

From the position of a synergetic approach it becomes evident that in these circumstances the country needs to make a choice between, first, spontaneous natural evolution of 'descending' to the third world and the direction that will make Russia a full-fledged participant in the process of defining and solving global problems. Second, standards imposed by transnational and European institutions and an independent vector of Russia's development in the multipolar world. Third, industrial raw materials-based and neo-industrial development based on innovative technology. Fourth, local resource-intensive projects and implementation of trans-territorial projects, which would ensure synergetic (self-organizing) and infrastructural effect for economy of the region and of the country as a whole. Fifth, there is a need to choose a new superposition for the regions, facilitating development of the country based on the strengths of each region and constituent entity of the Russian Federation.

Thus, in the context of the above, it shall be noted that the following objectives remain the highest priority for the social and economic development: improving quality of life; improving competitiveness of the economy through diversification of its structure and generation of investment flows; development of interregional cooperation; promotion of socio-economic development of constituent entities of the Russian Federation.

It is obvious that socio-economic development of Russia is dependent on the general global and national trends. One route forward is to remain a raw-materials appendage of the economy of Russia. The other route is neo-industrial, which is more preferred. Neo-industrial route implies:

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1. Combining the achievements of innovative technologies with a traditional way of life of indigenous peoples, whose ancestral lands were transferred to the companies and organizations, producing oil, gas and mineral resources, that quite often ignore traditional forms of nature management and economic activities of the northern peoples.

2. Compliance with environmental standards. For example, the extensive development of the wealth of the northern regions brought to the edge of extinction not only the natural habitat of indigenous people, but also all living creatures. Therefore, environmental imperative today shall become the core of the survival strategy of mankind.

The concept of 'environmental imperative' was proposed in the late 70^s by Academician N.N.Moiseev to designate a system of prohibitions imposed on the life of people in order to prevent the disastrous consequences awaiting the mankind in the near future. It would mean 'to find such a way for the development, that would reconcile human needs and active operations with the capacity of the planet's biosphere. Such a way may leave a hope that its further development would be still possible' [9, p.49].

3. Increasing productivity and quality of work, largely owing to the implementation of smart, balanced demographic policy. Due to intensive outflow of population from the northern and the Far East regions of the country an active involvement of the state in this process is required.

Meanwhile depending on demographic potential of the territories a differentiated approach is required, which combines both state regulation and stimulation of the territories, and self-organization of the resettlement system.

4. Ensuring maximum effect of economic, social, political, cultural projects related to the effective participation therein of the constituent entities of the Russian Federation including scientific and human potential.

It is the implementation of neo-industrial development project that will give the country a possibility to achieve social and economic growth and reach new standards of life in the region, successfully compete and develop at the Russian and global levels.

REFERENCES

1. *Agrikola Georgij*. On mining and metallurgy. Moscow: Izd-vo Akademii nauk SSSR, 1962, p.597 [in Russian].
2. *Arshinov V.I.*, *Budanov V.G.* Synergetics as a tool to shape a new image of the world. Chelovek, nauka, civilizatsiya: K 70-letiyu akad. V.S.Stepina. Otv. red. I.T.Kasavin. Moscow, 2004, p.428-463 [in Russian].
3. *Arshinov V.I.*, *Budanov V.G.* Synergetics: evolutionary aspect. Samoorganizatsiya i nauka. 1994, p.229-243 [in Russian].
4. *Budanov V.G.* Synergetics methodology in postnonclassical science: principles and perspectives. Postneklassika: filosofiya, nauka, kul'tura. St Petersburg: Izdatel'skiy dom «Mir», 2009, p.361-396 [in Russian].
5. *Budanov V.G.* Synergetic methodology. Voprosi filosofii. 2006. N 5. p.79-94 [in Russian].
6. *Gvardini R.* The end of new time. Voprosi filosofii. 1990. N 4, p.127-163 [in Russian].
7. *Il'in I.A.* Path to the evidence. Moscow: Izdatel'stvo «Respublika». 1993, p.432 [in Russian].
8. History and theory of evolutionary theory. Institut istorii estestvoznaniya i tekhniki AN SSSR. Otv. red. K.M.Zavadskiy. Leningrad, 1975, p.238 [in Russian].
9. *Moiseev N.N.* To be or not to be... for the humanity. Moscow, 1999, p.288 [in Russian].
10. *Prigozhin I.* From being to becoming. Time and complexity in the physical Sciences. Moscow: The Publishers KomKniga, 2006, p.296 [in Russian].
11. *Prigozhin I.*, *Stengers I.* Order out of chaos: Man's new dialogue with nature. Obsch. red V.I.Arshinova, Yu.L.Klimantovicha, Yu.V.Sachkova. Moscow: Progress, 1986, p.432 [in Russian].
12. *Rozin V.M.* Methodology. Establishment and modern state. Moscow: RAO MSPI, 2005, p.414 [in Russian].
13. *Stepanov E.I.* Support of modernization process in conditions of modern globalization. Konfliktologiya. Ezhekvartal'niy nauchno-prakticheskiy zhurnal. 2014. N 3, p.9-27 [in Russian].
14. *Stepin V.S.* Theoretical knowledge. Moscow: Progress-Traditsiya, 2000, p.390 [in Russian].
15. *Haken G.* Synergetics. Moscow: Mir, 1980, p.404 [in Russian].
16. *Shhedrovickiy G.P.* Philosophy. Nauka. Methodology. Moscow: Shk. Kul't. politiki, 1997, p.656 [in Russian].

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