

Analysis of Innovation and Innovation Activity using a Synergetic Approach

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Abstract. *The article examines the problem of innovation in the refraction of the synergetic method and analyzes the concepts of synergy (synergism) and emergence. Innovations are complex, self-organizing systems that include elements, systems, and networks. A wide range of points of view is presented in the scientific literature: from complete identification to denial of synonymy of the concepts of synergy and emergence, but even in this case, some similarities are cited, as well as a comparative analysis of the concepts of emergence and additivity. Emergence is characterized by the appearance of certain properties, qualities in a common one that were not characteristic of its individual parts.*

Key words: *innovation, innovation activity, synergy, synergism, synergetic effect, system, element, self-organization, additivity, emergence, creativity.*

Introduction

Synergetics as an interdisciplinary research method studies open, complex, self-organizing systems such as nature, society, and man. Complex systems are characterized by openness, a variety of elements, multilevel, emergence, dynamism, etc.

General methodological research on the problem of innovation and synergetics has been developed in the world philosophical, methodological and scientific literature by representatives of various fields of sciences and has been tested in scientific articles and monographs. The philosophical and methodological aspects of the problem are considered in the scientific research of E.N. Knyazeva, E.V. Porezanova, V.N. Tarasevich, Z.N. Shuklina, M.N. Abdullayeva, E.M. Izzetova, L.A. Gamidullayeva, B.O. Turaev. To achieve the scientific goal and solve the tasks set, such methods were used as: philosophical and historical reconstruction, analytical- synthetic, comparative-historical, systematic approach.

Literature Analysis

Man and society are complex systems. V.N. Tarasevich believes that innovations, which are one of the activities of man and society, are: "highly complex and predominantly self-organizing network-type systems with an extensive structure of internal and external interactions between not so much traditional elements that form a certain integrity, but coherent interactive processes that determine the dynamism of the system". [20. p. 35]

Innovation, innovation activity is an open, complex, self-organizing system. It includes and interacts with many constituent elements, structures, systems: innovators, an innovative idea, its implementation, i.e. innovative activity. "... we identify, writes Z.N. Shuklina, innovative egregors that arise as the development of the innovation process is formed at all stages of innovation management." [21. P. 70] By egregors, the author understands the algorithm of information processing and transformation.

"Innovation is the result of complex interactions between regional, national, and global organizations." [4. P. 504] L.A. Gamidullayeva emphasizes the systemic nature of innovations. "Synergetic interorganizational innovations can be attributed to the type of vertical synergetic innovations, which means cooperation between participants in the value chain (consumers, producers, suppliers, competitors, etc.)." [4. P. 504] Tarasevich considers innovations as super-complex, self-organizing systems. Innovations are systems, according to the author: nonlinear, stochastic, self-organizing. [20. p. 36]

In his scientific research, E.V. Kondratiev examines the synergetic foundations of management in the form of a scheme that can also be applied to innovation. He refers to the properties of an organization as openness, dynamism, complexity, self-development, emergence, nonlinearity, self-organization, etc. [10. p. 32]

Innovations have penetrated into all spheres of human activity and society. In innovation processes, the interaction of many components included in it takes place. "Openness to the outside world, with which there is an uncontrolled exchange of matter (resources), energy and information, can have revenge in space, time and scale." [14. P. 415] This fully reflects innovative activity, because without their interaction, exchange, innovation is impossible. Innovation is characterized by both sustainability and dynamism. The modern world has become dynamic, largely due to innovations that have become firmly embedded in our lives, and innovations themselves have become dynamically developing over the past 100 years. Innovation is a complex education that involves many elements. "The speed and intensity of innovative development is determined by the quality of management and its processes based on a synergetic approach." [21. p. 69]

Research and methods.

L.A.Gamidullayeva considers the following to be the synergetic property of innovative systems:

- 1) there are attractors in the innovation system that form areas of predictability;
- 2) Resonant excitation is possible in an innovative system;
- 3) an innovative system has the property of hysteresis, the system's resistance to innovation;
- 4) emergence, as a link between inter-element and intersystem connections, contributing to the coherence of actions;
- 5) self-organization of the innovation system: increasing organization and reducing uncertainty;
- 6) the complexity and non-linearity of the innovation system make it difficult to establish cause-and-effect relationships. [2. P. 70] Horizontal synergetic innovations are expressed in interaction with participants in innovation activities located in the same plane.

The article devoted to categorical analysis of the little-studied concept of "non-credibility" shows that this concept is often identified with emergence. And although there is no single definition of additivity, this concept, in particular in psychology, is often understood to have a greater effect of totality than of its parts. In this case, additeness can be identified with emergence. But still, this is not just a kind of summation effect. And therefore, according to A.I. Kreik and G.A. Cheremnykh: "it is incorrect to define emergence as incompleteness, and nonadditivity is one of the manifestations of emergence." [12. P. 106] And further, the authors propose the following definition: "nonadditivity is a result of interaction that is greater or less than the arithmetic sum of the results of the activities of each of their interacting parties individually ... $1+1>2$ or $1+1<2$ ". [12. P. 106] Synergy as the interaction of several factors, the total results of which exceed its individual components, is understood by the team of authors. "The synergy effect is significantly higher than the sum of the

effects of individual components, i.e. the result of joint actions exceed the simple sum of the individual actions of the system elements. ("1+1=3"). [13. P. 4]

In the modern literature devoted to the problem of synergetics, many scientists identify the concepts of synergism and emergence, understanding them as the mutual influence of the combined parts. For example, T.A. Akimova identifies both concepts. "In fact, in relation to common system properties, emergence and synergism are synonymous" [1. P. 178]. This scientific position is consistent with the opinion of Yu.V. Korechkov and O.V. Dzhioev, "The law of synergy is that any complex dynamic system strives to maximize its effect due to its integrity.; strives to maximize the integration possibilities to achieve the effects. The law of synergy is based on the principle of emergence of complex systems: the combined action of several factors always or almost always differs from the sum of separate effects." [11. p. 4]

A.S. Muratov and I.P. Povarovich defend a different point of view, arguing that both concepts cannot be synonymous: "a) these concepts cannot be identical and complementary under certain conditions, otherwise one of them simply would not exist; b) the law of synergy, even in market conditions, cannot be the only one. the basic law of the functioning and development of enterprises, firms, corporations, etc., since any development implies certain limitations" [15. P. 272] By emergence, the authors understand the emergence of new higher qualities in complex systems under the influence of external factors. And the main difference is the impact: synergy is formed under the influence of internal (endogenous) factors, and emergence – by external (exogenous) factors. Emergence is the changes that occur in socio-economic systems, while in biological systems such changes are called variability.

Results.

Noting the similarity of the concepts of "emergence" and "synergy", V.P.Popov emphasizes that emergence is characterized by the emergence of a new quality that cannot be reduced only to the sum of the properties of its elements. What is the difference between these concepts? "Synergy means a noticeable strengthening or weakening of an already existing quality with a certain interaction of elements. And emergence means the emergence of a new quality (useful or harmful)." [16. p. 56]

The concepts of synergy and emergence are also distinguished by A.V. Blok and co-authors. "Emergence (from the English. emergence – the emergence of a new one) is the appearance of new properties in a system that the elements forming the system did not have. Synergy is a phenomenon when the effect of the sum of interrelated elements (the system effect) is not equal to the sum of the effects forming the system of elements." [3. P. 26] The synergy effect can be positive and negative. It is positive if the sum of the parts of its synergy gives a greater effect than individually, and vice versa, when the sum of the elements has a lesser effect. After analyzing both concepts, we can conclude that synergy is more characterized by cooperation and assistance, while emergence is characterized by creativity and creativity. The authors state "that the concepts of "synergy" and "emergence" should have some kind of common origin, however, the points of view of experts on this issue differ diametrically (from their complete semantic separation to the identification of concepts)." [6. P. 297] As can be seen from the various points of view on these concepts given in the article, this is indeed the case.

E.N. Knyazeva argues that self-organization and emergence are concomitant phenomena. "Consciousness is an emergent, complexly organized and autonomous network of elements, and cognitive processes in consciousness are independent, new qualities arise at the level of consciousness that cannot be reduced to a substrate, neurophysiological basis." [6. P. 46] That is, emergence means the appearance of a new quality in a part, which will later become a property of the whole. Not just the appearance of a new one, but unexpected properties. "Emergence, like creative randomness, is rooted in existence, has an ontological basis. When they say that the new arises spontaneously, not deterministically, they emphasize the ontological aspect." [9. P. 79]

In modern scientific literature, the concept of emergence is considered in two meanings. The first meaning is: "Emerging are new, unexpected properties that appear at the dynamic level of the system as a whole, which cannot be "subtracted" from the analysis of the behavior of individual elements."

[8. P. 122] Complex are those systems in which emergence appears. Another meaning is very close to the co-creation of nature and society: "This is a way of creating novelty in the process of evolution of nature and society. The mutual activity of the system and the environment and the coordinated and interdependent emergence of new properties in the system can be called co-emergence." [7. p. 28]

Эмерджентность как свойство сложных систем появления, рождения нового, дало нам все многообразие нашего мира, представленного не только в material existence, but also the spiritual world of man. And this is the difference between emergence and additivity, in its creative nature. Emergence is a property of creativity, the creation of new things. The birth of a new one in human consciousness is possible only with the active and coordinated interaction of the system with the environment and the surrounding world. Sometimes emergence is understood as the unpredictability of the appearance of new properties, but this understanding implies its epistemological aspect, the incomprehensibility of the appearance of a new one.

Discussion.

The team of authors argues that the synergetic nature of socio-economic efficiency of information communication efficiency is due to various factors: from the economic scale, the network nature of the production of goods, the effect of economic laws to the formation of network markets with the effect of utility and value. "As a result, the production of digital technologies and services is becoming global, and the synergistic effect of their application depends on: the speed of information transmission and the bandwidth of communication networks.; the scale of application and the depth of penetration of ICT into production and life support systems; the degree of development of ICT and communication networks ..." [13. P. 14]

In addition to the concept of "synergy", the term "synergy" is also used. In his work, D.A. Ivanov expresses the following: "in our opinion, it is incorrect to use the term "synergism" in the financial literature" [5. P. 2595], arguing that the term synergism is used to name the Christian theological concept of the same name. Further, the author cites the example of V.A. Balaban [2. pp. 90-98], as a researcher who consciously uses the term synergism. Considering the synergy using the example of an economy that is currently innovative. E.V. Porezanova does not distinguish between the concepts of "synergy", "synergetic effect" and "synergism" and argues that its development can lead to: "linear synergy, nonlinear, expressed in under-synergy, reverse synergy, hypersynergy" [19. p. 511].

Classification of synergistic effects By degree of adjustability	
According to the degree of controllability	<ul style="list-style-type: none"> • Self-regulating effects; • With state participation; • Unregulated In terms of impact
In terms of impact	<ul style="list-style-type: none"> • Internal; • Hermeneutical; • External From the point of view of symmetry
From the point of view of symmetry	<ul style="list-style-type: none"> • Symmetrical; • Asymmetrical; • Antisemitic
The synergistic effects may be	<ul style="list-style-type: none"> • Interacting; • Complementary to each other; • Non-interacting In terms of cyclicity
According to the degree of reversibility	<ul style="list-style-type: none"> • Cyclical with positive dynamics; • Cyclical with negative dynamics; • Non-cyclical synergistic effects In terms of periodicity
In terms of periodicity	<ul style="list-style-type: none"> • Continuous and discrete\$ • Reproducible and non-reproducible
According to the degree of reversibility	<ul style="list-style-type: none"> • Random; • Natural

By the criterion of intensity	<ul style="list-style-type: none"> • Intense; • Non- intensive
According to the degree of progressivity	<ul style="list-style-type: none"> • Progressive; • Neutral; • Non- intensive
From the point of view of positivity	<ul style="list-style-type: none"> • Positive (pre-optimal); • Negative (suboptimal)

According to the above-mentioned author, positive synergetic effects occur when using new forms and methods that lead to an improvement in the economy. Negative (suboptimal) synergism: "nonsynergism, desynergism, resynergism, quasi-synergism, antisynergism." [[18. p. 521] Non-synergism is non-synergism, non-synergism, leading to stagnation or degradation. Reducing the synergistic effect is a synergy. With the opposite effect, even to the point of collapse, resynergism occurs. Antisynergism is a negative synergistic effect. The quasi-synergism of the emergence of the gray and shadow economy is expressed in the deterioration of the economy, the development of unaccounted-for products. [17. P. 129]

Conclusion

Thus, innovations, innovators, and innovation activities are complexly organized and self-organizing systems that are characterized by the creation or introduction of new things, followed by inclusion in the market space. By transforming the world around us, a person transforms himself and his consciousness, and transformation is possible only with the emergence of new ideas and goals, knowledge and discoveries, innovations and innovative activities. In synergetics, the emergence of new things is characterized by emergence, synergy, and synergy, which encompass systems of any nature.

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