HUMANITIES STUDIOS: Pedagogy, Psychology, Philosophy

Humanities Studios: Vol. 12, No. 4, 2024

Pedagogy, Psychology, Philosophy

Journal homepage: https://humstudios.com.ua/en

UDC 165.23:001.891:530.1

DOI: 10.31548/hspedagog/4.2024.78

Synergetics and the problem of objectivity in scientific knowledge

Tetyana Kondratyuk-Antonova*

PhD in Philosophical Sciences, Professor
Kyiv Institute of the National Guard of Ukraine
03179, 7 Oborony Kyiv Str., Kyiv, Ukraine
https://orcid.org/0009-0002-6548-7772

Natalia Polishchuk

Doctor of Philosophy, Professor
Rivne State Humanitarian University
33028, 12 Stepana Bandery Str., Rivne, Ukraine
https://orcid.org/0000-0001-9498-4837

Oksana Silvestrova

PhD in Philosophical Sciences, Associate Professor
Lutsk National Technical University
43018, 75 Lvivska Str., Lutsk, Ukraine
https://orcid.org/0000-0002-8930-8698

Abstract. The relevance of this article was determined by the significance of objectively understanding nonlinear, chaotic systems, which are a product of the dynamic nature of modern science and are addressed by synergetics. The study aimed to conduct a theoretical investigation into the objectivity of scientific knowledge by employing synergetics as a non-traditional scientific paradigm within the contemporary philosophy of science and other interdisciplinary domains. The research methods applied included theoretical, historical, and interdisciplinary approaches, as well as mathematical modelling. It has been established that synergetics represents a meta-approach that emerged both as a response to the crises of the 20th and 21st centuries and as a consequence of globalisation, technological progress, and a shift in the perception of natural processes. It has been determined that synergetics, as a scientific discipline, and the synergetic approach, as an interdisciplinary method of scientific inquiry, enable an objective examination of non-equilibrium and nonlinear transformational processes due to the presence of a theoretical and mathematical framework. It has been generalised that the objectivity of scientific knowledge in synergetics is ensured by methods such as nonlinear thermodynamics of non-equilibrium processes, nonlinear oscillation theory in radio-technical systems, differential typology, catastrophe theory, tensor analysis, non-equilibrium statistical physics, qualitative theory of differential equations,

Received 13.08.2024 Revised 01.11.2024 Accepted 27.11.2024

Suggested Citation:
Kondratyuk-Antonova, T., Polishchuk, N., & Silvestrova, O. (2024). Synergetics and the problem of objectivity in scientific knowledge. *Humanities Studios: Pedagogy, Psychology, Philosophy*, 12(4), 78-89. doi: 10.31548/hspedagog/4.2024.78.

*Corresponding author

and dynamical systems theory. It has been noted that the methodological and statistical framework of synergetics, as a universal method complementing cybernetics, is a composite approach incorporating elements from various fields of scientific inquiry. The study has demonstrated that within the synergetic paradigm, the concept of "chaos" has been reinterpreted, shifting from a destructive force to a creative source of alternative order through the process of self-organisation, which generates order from chaos. It has been indicated that synergetics represents a paradigm for the emergence of new qualities and provides a mathematical explanation of their development by applying nonlinear differential equations and bifurcation theory, which characterise the transition from quantitative changes to qualitatively new states. The practical significance of this study lies in presenting a new perspective on the objectivity of scientific knowledge, grounded in an understanding of the dynamics of self-organisation in complex systems, thereby facilitating the development of comprehensive approaches to addressing contemporary challenges within interdisciplinary frameworks

Keywords: synergetic paradigm; self-organisation of systems; open nonlinear systems; fluctuation; bifurcation; creative evolution

Introduction

If science is understood as an act of recognising reality, then the emergence of synergetics serves as evidence not only of changes in contemporary reality but also of shifts in human consciousness, marking the beginning of creative evolution (Gerasymchuk, 2024). The accumulation of knowledge, a natural consequence of the crises of the 20th and 21st centuries and the rise of non-classical science with its focus on systems thinking has led to a scientific revolution. This revolution was triggered by the breakdown of fundamental concepts familiar to classical science. The advent of cybernetics, thermodynamics, quantum theory, and both general and special relativity increasingly compelled humanity towards a change in awareness. This change involved a growing need to establish connections between diverse fields of knowledge, which, as argued by Ya. Tararoyev *et al.* (2023), has inexorably led to the necessity of finding systematic links between scientific knowledge, engineering, and technology.

In turn, the transformation of scientific knowledge, resulting from the shift in philosophical tendencies from the classical to the non-classical paradigm, has led to a decreasing emphasis on absolute objectivity in favour of a growing reliance on subjective research methods. At the same time, the tendency of non-classical science to incorporate subjective factors into research has influenced perspectives on the problem of objectivity in scientific inquiry. To some extent, researchers have increasingly prioritised theoretical methods and approaches to understanding reality, while also paying greater attention to examining the nature and impact of these methods. This shift has led to a decline in empiricism in studies concerning the essence of natural phenomena, reinforcing the transition of scientific inquiry towards purely theoretical epistemological pursuits. Consequently, in the modern world, the principles of pluralism and relativism have gained particular relevance, serving as a suitable foundation – or even a response to contemporary challenges – for the emergence and development of synergetics as an anti-crisis framework. As noted by L. Shumeiko (2023), such a framework may prove invaluable in addressing societal disillusionment with the concept of linear progress, fostering instead a greater focus on individualisation and a renewed interest in existentialism and personalism.

Thus, synergetics emerged in scientific inquiry not merely as a differentiated field of research but as a meta-approach – a response to

humanity's crisis of outdated worldviews, the understanding of natural processes, and the mental evolution driven by globalisation and technological progress. It may be said that the faster the world advances in its relentless development, the more individuals tend to deepen their perception of the interconnectedness of all things, embracing as "pure knowledge" the notion of a seamless unity between organic and inorganic nature, as reflected in F. Schelling's (1798) concept of the "world soul". In this sense, the discovery of synergetics in contemporary science can be seen as a means of taking a fresh breath of air – finding new meanings and foundations for constructing the science of the future. Alternatively, it may be interpreted as an expression of the collective unconscious striving for the realisation of creative evolution, driven by the desire to cultivate a new mode of thinking that enables a fundamental re-evaluation of worldviews and the evolution of objective reality. From the perspective of the authors of this study, the qualities inherent in synergetics – nonlinearity, openness, alternativeness, and instability – may well represent the essence of scientific knowledge. Synergetics has the potential to establish the rules for forming a coherent, internally consistent whole from diverse chaotic elements. It can synthesise the transformation of simple connections into complex ones, creating new forms of creativity, and analysing the unpredictability of pathways at bifurcation points. In doing so, synergetics creates a breakthrough in the metaphysics of knowledge, the so-called sphere of reason, which precedes the future development of the synergetics of the noosphere and fundamental ontology.

According to the concept of the Austrian scientist I. Prigogine, the father of synergetics, the main goal of the "neo-philosophy" embodied in the synergetic paradigm is the search for and discovery of new mechanisms of survival for the modern society and the society of the future (Prigogine & Stengers, 1984). After all, the very system of principles of the synergetic paradigm is primarily aimed at helping to overcome one-sidedness in solving the main social and educational contradictions. This new paradigm, in the authors' view, departs from previous ones in its approach to decision-making for any society or individual. It is characterised by a lack of adherence to the concept of a dichotomy between good and evil. Furthermore, this new paradigm does not attempt to rely on the illusory stability of existence, thereby creating a trajectory of development within the context of disordered chaos, multi-variance, and general disarray on the path to an inevitable encounter with bifurcation points (Morhun, 2019). Thus, the discovery of synergetics as a science characterises the individual as an active participant in the evolutionary process, reorienting the integration of knowledge and style of thinking into more humanistic and creative contexts of scientific knowledge. This article aimed to conduct a theoretical study of the relationship between synergetics and the objectivity of scientific knowledge, as well as an analysis of how the principles of synergetics influence the understanding of objectivity in the context of modern scientific approaches.

Literature Review

The analysis of recent studies and publications highlights the functional versatility of various aspects of synergetics as an interdisciplinary paradigm of a new methodology for scientific inquiry. Its practical applications extend across multiple fields of knowledge, including medicine, education, cybernetics, chemistry, philosophy, and the synergies among these disciplines. For instance, the study by N. Batechko (2016) explores the application of synergetic principles as a methodological tool for addressing contemporary complex challenges in education and for shaping national educational policy. Expanding on this research, N. Batechko & Y. Chuhayeva (2022) examine the response mechanisms of synergetic effects within complex information systems, particularly in the context of cyber threats and various forms of information attacks, focusing on resilience and adaptation processes. Meanwhile Gerasymchuk (2024)

investigates the impact of systemic crisis factors on transformations within the international system, employing a synergetic approach as a methodology for analysing destabilisation and adaptation processes in global politics.

As H. Birta & Yu. Burhu (2014) point out in their work, synergetics has been undergoing rapid development in recent times. It is a theory that studies the self-organisation and evolution of open systems of various natures: natural, social, and cognitive. The key concepts of synergetics are order, chaos, nonlinearity, instability, and uncertainty. These concepts are closely related to several philosophical categories, in particular being, development, becoming, time, integrity, chance and possibility, which contribute to their mutual penetration and integration. The book by V. Kamyshyn *et al.* (2018) is devoted to the use of synergetic approaches in the educational system, in particular in working with academically gifted students. It examines the theory of self-organisation and the development of open systems, which offers a methodology for understanding complex learning and development processes. The authors analyse the influence of key educational dominants and levels of aspirations on the effectiveness of the educational process. In particular, the interrelationships between students' self-esteem, their ability to make decisions and achieve a synergetic effect in learning are investigated. This approach not only improves the quality of education but also contributes to the development of individual talents and the creation of optimal conditions for their realisation.

The scholar O. Dzeban (2011) explores the synergetic approach as an effective methodology for analysing complex social systems. His study examines the role of synergetics in legal science, emphasising its importance for building effective legal systems that can adapt to modern challenges. The importance of self-organisation and harmonisation of legal norms in society is emphasised (Kovalenko & Bezverkha, 2018). Similarly, V. Nadurak (2014) examines the system of public morality through the prism of synergetics, in particular the interaction of moral principles as a complex nonlinear system that ensures social stability and development. Both works offer an innovative approach to understanding social phenomena, which is based on the ideas of self-organisation, nonlinearity and integration of different spheres of public life.

T. Kilochytska *et al.* (2023) analyse the use of synergetics as a method of scientific knowledge to explore the features of students' cognitive independence, paying considerable attention to self-organisation, as well as the process of adaptation to learning as a predictor of the development of cognitive abilities. The authors note the significance of the contribution of a multifaceted analysis of the synergetic approach to student interactions and self-organisation processes. O. Kutsyi (2022) examines the theoretical and practical features of synergy within the general scientific, as well as organisational and psychological dimensions, analysing synergy as an interdisciplinary phenomenon, emphasising the role of interaction processes between members of groups and organisations to achieve common goals. In his work, the author considers synergy as a fundamental principle for creating an effect that exceeds the sum of individual influences and contributions. The scholars A. Loburets *et al.* (2022) analyse the features of synergetics and selforganisation processes within the framework of the study of two-dimensional systems, focusing on the mechanisms aimed at controlling their inherent dynamics. The use of the principles of synergetics as scientific knowledge is used by the authors in their research to determine the genesis and patterns of its course in significant systems for ecology, biotechnology and chemistry.

I. Liashchenko (2020) in his article analyses culture as a complex dynamic system, considering it within the framework of the synergetic paradigm, subject to the principles of self-organisation, using the ability to consider culture as a nonlinear and complex system that is permanently between chaos and order. The problem of the metaphysical definition of unity and being in the

synergetic paradigm was studied by the author O. Morhun (2019). He analyses the connection between the process of unity of thinking and being, defining the relationship between thinking as a creative process and the objective reality of being, thereby integrating the synergetic paradigm of methodological research as a metaphysical analysis. In her study, O. Naumkina (2021) characterised the importance of post-non-classical science as an integration of modern research methods for analysing complex systems by creating transdisciplinary approaches, considering synergetics as a key determinant of the evolution of systems that are difficult or impossible to describe using classical research methods.

L. Shumeiko (2023) conducted an analysis of the principles of synergetics in the context of art education to optimise the learning process and the formation of democratic and flexible approaches to the organisation of the educational process, offering recommendations for the implementation of synergetics in the creative learning process. O. Parkhomenko *et al.* (2022) considered the importance of combining a systematic-creative approach with a synergetic approach to create natural self-regulation as a way of sustainable development of society against the background of the ecological crisis and other global challenges. Therefore, an analysis of modern publications on the topic of this publication illustrates synergetics as a powerful method of scientific knowledge for conducting interdisciplinary scientific research, which is aimed at providing a deep understanding of complex processes in technical, natural, educational and social systems of functioning, development and interaction.

Materials and Methods

In the creation of this article, the authors employed theoretical, historical, and comparative methods to investigate the problem of synergetics as the subject of objective scientific knowledge. As part of the theoretical analysis, 26 scientific studies were used and examined over the course of three months, forming the informational base of this research. The foundational work for investigating the issue of synergetics as the subject of objective scientific knowledge was the book by I. Prigogine & I. Stengers (1984), which embodies the essence of understanding the peculiarities of synergetics as a method of scientific knowledge. Other sources used in this study, forming the basis of the research, consist of scientific articles and books by both Ukrainian and international researchers, addressing various aspects of the study of synergetics as a science. They also explore the application of synergetics as a method of scientific knowledge across different fields, examining both practical and theoretical aspects of its use in addressing current issues in medicine, education, and other sectors. In writing the article, the authors analysed scientific sources published between 1984 and 2024, which allowed for a deep immersion into the investigated problem. The use of the theoretical method contributed to the formulation of the main research problem, aiming to illustrate the impact of synergetics on the objectivity of scientific knowledge.

For a more thorough investigation of the topic of synergetics as the subject of objective scientific knowledge, the authors also applied mathematical modelling methods and an interdisciplinary approach. This enabled a deeper analysis of the aspect of objectivity within the paradigm of this new scientific method, synergetics. The use of the historical method provided a detailed examination of the evolution of scientific theories of cognition – ranging from classical to modern scientific approaches such as synergetics. The comparative research method allowed the authors to highlight the distinctive features of synergetics in comparison with other methodologies of scientific knowledge. This, in turn, facilitated the systematisation of knowledge and the creation of the author's table. The interdisciplinary research method was employed to reveal

the universality of synergetics and to determine its significance within other fields of knowledge. The application of mathematical modelling characterised the use of mathematical tools in synergetics, which served to confirm the reliability and accuracy of the objectivity of scientific knowledge in the analysis of complex systems. Thus, a wide range of methods and materials was used in the creation of this article, allowing for an analysis of the problem of synergetics as the subject of objective scientific knowledge through comprehensive theoretical and mathematical analysis within a broad historical retrospective, as embodied in the variety of scientific research applied.

Results and Discussion

The relationship between synergetics and the objectivity of scientific knowledge

The term "synergetics" first appeared in the world in 1973 in a report entitled "Cooperative Phenomena in Strongly Nonequilibrium and Non-physical Systems", in which synergetics was presented as a theory of joint action, or, as it is known to modern scientific circles, the science of self-organisation. The emergence of this term belongs to the German researcher H. Haken (1977), who approached the emergence of synergetics while studying the coordination of the behaviour of atoms in a laser. Later, the researcher expanded the scope of this term and presented synergetics as a universal method of explaining phenomena in physics, chemistry, and biology. Thus, synergetics embodies a method of studying the spontaneous transition of non-equilibrium systems from less complex to more complex and more ordered forms of organisation of systems. Synergetics represents a new stage in the study of complex systems, expanding upon systems theory and complementing cybernetics (Kilochytska, 2014). A comparative analysis of the concepts of cybernetics, systems theory, and synergetics reveals key distinctions. Cybernetics, in essence, is aimed at ensuring the stability of systems through the application of negative feedback. Systems theory, meanwhile, focuses on investigating the principles of their organisation. Synergetics, in contrast, concentrates on studying the features of non-equilibrium and instability of the natural state of open nonlinear systems, as well as the multi-level nature and ambiguity of their evolutionary paths. Thus, synergetics studies the types of behaviour of such systems, which represent non-stationary structures that arise under the influence of external factors or as a result of internal factors, such as fluctuations.

The foundation of objective scientific knowledge, embodied in the methodological-statistical apparatus of synergetics, consists of the ideas and methods of nonlinear thermodynamics of nonequilibrium processes, the achievements of nonlinear theory of oscillations in radio-technical systems, qualitative theory of differential equations, and a substantial mathematical apparatus within the theory of dynamic systems. Thus, the mathematical apparatus of synergetics is combined and borrowed from various fields of scientific knowledge, including group theory, nonlinear nonequilibrium thermodynamics, catastrophe theory, differential typology, nonequilibrium statistical physics, and tensor analysis. According to Professor H. Haken's concept, synergetics is a specific metascience that has an "international" character concerning other sciences, occupying a central place in scientific knowledge, studying the general nature of dependencies and patterns, which led to the discovery of interpretations and solutions to synergetic problems in various fields of science (Dzhuzha & Tychyna, 2019). However, this does not contradict the principles of objectivity in synergetics as a domain of scientific knowledge. The inherent differences between the features of the linear concept of scientific knowledge and the synergetic concept, as a response to the crisis of the 20th and 21st centuries and the flourishing of creative evolution, are presented in Table 1.

Table 1. *Comparative analysis of linear and nonlinear methods of scientific knowledge*

Subject of scientific knowledge	Scientific knowledge concepts	
	Classical linear paradigm	**Neoclassical synergetic paradigm**
Model of the world	Considered as a mechanistic structure, somewhat akin to a machine	Considered as a complex of interconnected and selforganising systems
Evolution and progress	The understanding of progress within scientific knowledge represents a linear, and also the only correct, path to development	The understanding of evolution within scientific knowledge is nonlinear and includes multiple possible developmental trajectories
Role of the environment	The external environment is defined as static and insignificant	The external environment plays an active role in the processes of change, also affecting the adaptation and development of systems
Stability and change	Stability is prioritised. Change is viewed as undesirable, while stability is preferred	Change is embraced, and its adaptive significance for the process of evolution and self-organisation of systems is recognised
Attitude to the system	The system is considered closed and independent of various external influences and micro-fluctuations	The system is considered open and dependent on external influences and internal fluctuations
Cause-and-effect relationships	Linear and their consequences are seen as directly proportional to the causes	Nonlinear, and their results are characterised as exceeding expectations or not aligning with them
Causal relationships	Development occurs linearly, progressively, and without alternatives	Development is nonlinear, includes alternatives, and adaptive changes depending on the environment
Attitude to imbalance	Imbalance is considered a negative phenomenon that must be overcome	Imbalance is viewed as the driving force behind the development of systems
Role of randomness	The concept of randomness is a secondary, marginal factor	The concept of randomness is a significant factor, which acts as a determinant for the development and selforganisation of systems
The idea of chaos	Chaos is seen as a destructive factor that must be eliminated	Chaos plays an important role in the processes of system development and is not limited to a destructive function

Source: *developed by the authors*

Linear and nonlinear methods of scientific knowledge are characterised by fundamentally different approaches to the perception of the surrounding reality. Thus, the linear paradigm of scientific knowledge is characterised by a high degree of predictability and clarity, which ensures the factor of objectivity within the framework of simple, as well as stable systems, while the nonlinear paradigm (characteristic of synergetics) provides the possibility of objective research of multidimensional, complex and dynamic systems. The objectivity of the nonlinear, synergetic paradigm of scientific knowledge is based on the use of interrelationships of emergent properties and adaptation. On the contrary, such universality of synergetics contributes to the emergence and development of a sufficient number of studies of a socio-humanitarian direction, which leads to the understanding of synergetics as a universal theory of evolution. This, as a result, is a certain basis for the emergence of mechanisms of any innovation.

It should be noted that the field of synergetics research does not have a clear definition and, most likely, cannot be limited because the interests of this science extend to all branches of scientific knowledge, natural science, the general feature of which is the study of the dynamics of any irreversible processes and the emergence of fundamental innovations (Kremen, 2014). Therefore, synergetics as a science has absorbed a significant theoretical and methodological base to reliably contribute to the development of interdisciplinary research as an objectively reliable tool of scientific knowledge and a statistically

and mathematically grounded methodological paradigm of modernity.

Understanding complexity through the synergetic framework

In philosophical and methodological sources, synergetics is a tool of scientific knowledge entirely aimed at the search for universal laws and algorithms of evolution and co-evolution of complex (nonlinear) non-equilibrium systems, which are the subject of research in the context of various ontologies. It can be said that synergetics was formed as a result of the influence of analogical thinking and comparative analysis, which represent one of the most important components of multidimensional philosophical thinking on the way to creating general scientific knowledge. Also, synergetics can be considered as a theory of the formation of new qualities. This is due to the fact that synergetics mathematically explains, using systems of nonlinear differential equations, how the branching of the old quality into new ones occurs, which is what the theory of bifurcations reflects. The bifurcation mechanism makes understandable the transition from quantitative changes to a qualitatively new choice. The strategy of the scientific search for synergetic systems can be represented as a branched graph that reproduces the alternative of development. The choice of the future trajectory of development depends on the initial conditions, the elements that are included in the system of local changes, random factors and energy influences (Kremen, 2014; Tryfonova, 2016).

Within the framework of synergetics, the internal link of the world's evolution and self-improvement is a natural flow of probabilities, which includes both deterministic, linear, and stochastic, nonlinear aspects. In this context, randomness is considered not as an unattainable necessity, but as a property of the behaviour of an open system in a non-equilibrium state. Matter, within the synergetic approach, ceases to be defined as a passive substance, which was previously described only in the mechanistic paradigm. The discovery of synergetics reveals such a quality of matter as its spontaneous activity. That is, the transformation of open non-equilibrium systems is explained not only by their reactions to changes in the environment but also by spontaneous fluctuations and innovations that naturally arise in these systems. From this arises a rethinking of the concept of "chaos", which consists in considering it as a creative principle and a constructive mechanism for the development of complex systems. In the context of synergetics, it is believed that chaos, being both destructive and constructive at the same time, contributes to the emergence of order through the process of self-organisation. I. Prigogine & I. Stengers (1984) emphasise that the source of order is the imbalance itself since it generates order from chaos. Therefore, the recognition of the effectiveness of small resonant influences on the system is a key aspect of the synergetic paradigm. According to the supporters of this paradigm, the transformation of a complex system is not limited only to the use of energy or power influences (Hrazhevska, 2006). Simple pressure directed at the system often leads to the fact that it is "reflected" in its previous structures, which are already built at certain levels of organisation (Tkachenko, 2013). Therefore, the introduction of fundamentally new structures requires an unconventional approach based on managerial influences in the field of order parameters, which may be small, but have an accurate topology and are directed at bifurcation points (Khodakivskyi *et al*., 2009).

The rejection of the impartiality of scientific knowledge and the inclusion of axiological value aspects in explanatory and predictive models becomes an important stage in the development of the scientific approach. In the context of the concept of self-organisation, the mind is considered a fundamentally new quality of self-organising systems, capable of reflecting on the stages already passed and predicting future states of the system. The involvement of a person in the self-organising universe and the recognition of the

relationship of the human world with other worlds gives global evolution a humanistic meaning. The mind, which acts as a determining factor in interaction with the environment, becomes a key factor in the evolution of the noosphere as a single "society-nature" system (Nakonechna, 2017).

The recognition of the basic limitations in predicting and controlling the behaviour of an unstable system, which manifests unpredictability both at the global level, carried out by attractors, and at the local level - by bifurcation. According to I. Prigogine & I. Stengers (1984), "events on a human scale indicate that social structures on this scale deviate from determinism... We can "explain" past events. We can consider them almost as a result of hidden determinism, but we do not have the ability to predict future events". Therefore, synergetics is a tool for understanding complex, nonlinear systems in the context of their inherent evolutionary and self-organising processes, explaining the process of emergence and development of new qualities through bifurcation mechanisms, in which the category of chaos determines the transition of processes and systems to the creation of new levels of order.

Conclusions

The use of classical methods of scientific knowledge experienced a breakdown as a result of the revolutionary discovery of quantum theory and other evidence of fundamental changes in social consciousness. Synergetics is a decisive response to changes in the world-view paradigm of scientific knowledge since the inconsistency of classical methods did not meet the scientific aspirations of contemporaries, which becomes a predictor of the emergence of neo-classical philosophy, which is reflected in the principles of the synergetic paradigm aimed at solving the main problems of the dynamic, technological, chaotic world.

Therefore, synergetics, as a new methodology, is characterised by the ability to study and determine the development of disordered, noliear, multi-variant systems within the framework of interdisciplinary approaches to various fields of scientific knowledge. The problem of the objectivity of synergetics as a scientific methodology is based on a reliable mathematical, methodological and statistical apparatus, which is characterised by a synthesis of combined and borrowed methods from various fields of scientific knowledge. Therefore, synergetics embodies a universal scientific and methodological construct of an evolutionary nature, which does not have a clear subject of research, since the synergetic paradigm is an interdisciplinary basis for the emergence and development of any irreversible processes and innovations.

In the context of modern scientific approaches, synergetics is widely used as an extremely powerful interdisciplinary construct of scientific knowledge, which ensures the analysis of complex processes within the framework of the functioning, development and interaction of complex processes. However, modern life increasingly requires the application of new approaches in scientific, technical, social, natural and other areas of scientific life, which is characterised by the need to accept the content of matter as an active substance, and also requires the inclusion of axiological and humanistic content regarding the development of a modern scientific approach in which a fundamentally new quality of systems is the category of mind and creative approach with the involvement of a person in interaction with a self-organising and self-developing environment. The prospects for further research lie in the study of the potential of chaos and the features of bifurcation as a driving force for deepening the process of creative evolution of the individual.

Acknowledgements

None.

Conflict of Interest

None.

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Синергетика і проблема об'єктивності в науковому пізнанні

Тетяна Кондратюк-Антонова

Кандидат філософських наук, професор
Київський інститут Національної гвардії України
03179, вул. Оборони Києва, 7, м. Київ, Україна
https://orcid.org/0009-0002-6548-7772

Наталія Поліщук

Доктор філософських наук, професор
Рівненський державний гуманітарний університет
33028, вул. Степана Бандери, 12, м. Рівне, Україна
https://orcid.org/0000-0001-9498-4837

Оксана Сільвестрова

Кандидат філософських наук, доцент
Луцький національний технічний університет
43018, вул. Львівська, 75, м. Луцьк, Україна
https://orcid.org/0000-0002-8930-8698

Анотація. Актуальність статті зумовлена значущістю об'єктивного пізнання нелінійних, хаотичних систем, які є результатом динамічної сучасної науки та викликам яких відповідає наука синергетика. Мета статті полягала у проведенні теоретичного дослідження щодо об'єктивності наукового пізнання шляхом використання синергетики як нетрадиційної наукової парадигми як у напрямку

сучасної філософії науки, так і в інших міждисциплінарних сферах. В якості використаних методів дослідження були застосовані: теоретичний, історичний, інтердисциплінарний методи, а також метод математичного моделювання. Встановлено, що синергетика представляє собою метапідхід, який виник як своєрідна відповідь людства на кризу XX-XXI століть й одночасно як результат процесів глобалізації, технічного процесу, а також певної революції усвідомлення протікання природних процесів. Визначено, що синергетика як наука та синергетичний підхід як інтердисциплінарний метод наукового пізнання дають можливість об'єктивно досліджувати нерівноважні та нелінійні трансформаційні процеси завдяки наявності теоретико-математичного апарату. Узагальнено, що об'єктивність наукового пізнання синергетики забезпечують методи нелінійної термодинаміки нерівноважних процесів, нелінійна теорія коливань у радіотехнічних системах, диференціальна типологія, теорія катастроф, тензорний аналіз, нерівноважна статистична фізика, якісна теорія диференціальних рівнянь, теорія динамічних систем. Зазначено, що методологічно-статистичний апарат синергетики як універсального методу, що доповнює кібернетику, є комбінованим та запозиченим від різних областей наукового пізнання. Досліджено, що в рамках синергетичної парадигми переосмислено розуміння «хаосу» від руйнівного початку до творчого джерела альтернативного порядку через процес самоорганізації, що народжує порядок із хаосу. Вказано, що синергетика являє собою парадигму формування нових якостей та математично пояснює особливості їх розвитку шляхом застосування нелінійних диференціальних рівнянь та теорії біфуркацій, що характеризує перехід від кількісних змін до якісно нового вибору. Практична цінність роботи полягає у висвітленні нового бачення об'єктивності наукового знання, що засноване на розумінні динаміки самоорганізації складних систем та передбачає можливість розробки комплексних підходів до вирішення сучасних проблем в рамках міждисциплінарних підходів

Ключові слова: синергетична парадигма; самоорганізація систем; відкриті нелінійні системи; флуктуація; біфуркація; творча еволюція