

UDC 351.354:303.094.7

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## SYNERGISTIC APPROACH TO GOVERNANCE: CHALLENGES AND OPPORTUNITIES

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### СИНЕРГЕТИЧНИЙ ПІДХІД ДО ДЕРЖАВНОГО УПРАВЛІННЯ: ВИКЛИКИ І МОЖЛИВОСТІ

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### СИНЕРГЕТИЧЕСКИЙ ПОДХОД К ГОСУДАРСТВЕННОМУ УПРАВЛЕНИЮ: ВЫЗОВЫ И ВОЗМОЖНОСТИ

*The article focuses on the theoretical foundations of synergetic approach to public administration. Theoretical concepts, trends and practical approaches to implementing a synergetic approach that lead to changes in the socio-economic system have been studied. Comparative analysis between traditional and synergetic approaches to governance has been fulfilled; their main advantages and disadvantages have been identified. The creation of monitoring system of open nonlinear environment by which to determine the extent of its instability, and the use of macro- and micro-analysis to determine the parameters of an unstable state have been suggested. The use of information mechanism of public administration on the basis of e-government, which should provide the necessary system data and results of analysis of the socio-economic system and provide information on possible ways of its development have been proposed.*

**Keywords:** synergy, openness, nonlinearity, nonequilibrium, chaos, self-organization, bifurcation point, fluctuations dissipative structures, attractors, negative feedback, positive feedback.

*У статті розглядаються теоретичні основи синергетичного підходу до державного управління. Досліджено теоретичні концепції, тенденції та практичні підходи до реалізації синергетичного підходу, які призводять до змін в соціально-економічній системі. Проведено порівняльний аналіз традиційних і синергетичних підходів до управління, визначені їх основні переваги та недоліки. Обґрунтовано необхідність створення системи моніторингу відкритого нелінійного середовища за допомогою якого можна визначити ступінь його нестійкості, а також використання макро- і мікроаналізу для визначення параметрів нестійкого стану. Запропоновано використання інформаційного механізму державного управління на основі електронного уряду, який повинен забезпечити необхідні системні дані і результати аналізу соціально-економічної системи і надати інформацію про можливі шляхи її розвитку.*

**Ключові слова:** синергетика, відкритість, нелінійність, нерівноважність, хаос, самоорганізація, точки біфуркації, флуктуації, дисипативні структури, аттрактори, негативний зворотний зв'язок, позитивний зворотний зв'язок.

*В статье рассматриваются теоретические основы синергетического подхода к государственному управлению. Исследованы теоретические концепции, тенденции и практические подходы к реализации синергетического подхода, которые приводят к изменениям в социально-экономической системе. Проведен сравнительный анализ традиционных и синергетических подходов к управлению, определены их основные преимущества и недостатки. Обоснована необходимость создания системы мониторинга открытой нелинейной среды с помощью которого можно определить степень ее неустойчивости, а также использования макро- и микроанализа для определения параметров неустойчивого состояния. Предложено использование информационного механизма государственного управления на основе электронного правительства, который должен обеспечить необходимые системные данные и результаты анализа социально-экономической системы и предоставит информацию о возможных путях ее развития.*

**Ключевые слова:** синергетика, открытость, нелинейность, неравновесность, хаос, самоорганизация, точки бифуркации, флуктуации, диссипативные структуры, аттракторы, отрицательная обратная связь, положительная обратная связь.

**Problem statement.** The basis for the creating and development of effective governance is the application of modern scientific approaches in the work of public authorities, ways and methods that allow using the achievement of governance science. Nowadays the conditions in which the system of public administration performs its functions are significantly different from those that were ten or fifteen years ago. The development of information technologies and the emergence of the basic elements of the information society in many countries have accelerated socio-economic and political processes.

Free and rapid flow of information presents new challenges to governance, which in the new environment must adapt to new challenges and exploit new opportunities provided with modern information society. These new approaches are scientifically based and allow making optimal decisions with using of modern technologies. One of the most promising modern scientific approaches, which allows to adequate evaluate the processes occurring in the country and provide the tools to influence these processes is a synergetic approach. This approach allows us to abandon the traditional vision of governance systems which operates in the linear environment and uses negative feedback. This approach involves consideration of self-organization and self-development of open nonequilibrium systems.

**Analysis of recent research and publications.** The study of theoretical and methodological aspects of using synergetic approach in governance, considered in studies of Dobronravov I.S. Bilous V.S. Derbentsev V.D. Ilchenko B.V., Nicolis, G. Haken G., Knyazev E.N., Kurdyumov S.P., G.G. Malinetskii G.G., Milovanov V.P., Bevzenko L.D. Bogutsky Y.P. However, despite the significant achievements of these authors remain poorly studied issues related to the use of synergetics in research of the processes in the governance on the levels of state and state associations.

**Allocation of the unsolved earlier parts of the overall problem.** Despite the fundamental research different approaches to development of government administration, the problems of implementing effective approaches to the governance in the modern conditions not enough researched. One of the important problems is the research of characteristics and basic synergetics ideas in applying to improve of governance. Therefore, the problem of using a synergistic approach to support of the system of government administration is particularly relevant.

**The objectives of the article.** The purpose of the article is substantiation of synergetic approach to research processes of governance. The object of the study is the process of formation and using of synergistic approach to governance. The subject of research is theoretical concepts and practical approaches to the introduction of synergetic approach to governance.

**The main results of the study.** The modern world is characterized by rapid changes in organizational systems at various levels and different nature. This is especially true for public administration systems, and interstate governance. Classical science uses a deterministic approach to management and governance. Scientific knowledge is associated with the concepts of simplicity, linearity and complete elimination of uncertainty. This is a simplified theoretical scheme, which excluded many parameters, and first of all - time and randomness. Chaos seems like the beginning of a destructive world. Randomness is considered a secondary factor. Disequilibrium and instability are seen as annoyances that must be overcome. Development is understood as a linear, progressive, without alternatives. If there are alternatives, they are random deviations from the main flow. One of the most important approaches in classical science is a cybernetic approach. Cybernetics is the science of the general patterns of management processes and transmission of information in the technical, biological and social systems [7].

The basic concepts of cybernetics that refer to management and public administration are: subject of management, object of management, organization, feedback, algorithm, model, optimization, signal, etc. For systems the concept of "Management" can be defined as follows: management is the impact on the object that selected on the basis of the available information from a variety of possible impacts, altering object's function or its development. In management systems there is always a certain set of possible changes, from which we can select the preferred changes. If the system has no choice, there can be no question of management.

Any management system is seen as the unity of subject of management and object of management. A management system always occurs in the environment. The behavior of any system is always studied with regard to its relations with the environment. Singling out an object, you must take into account the influence of the environment on the object and vice versa. A necessary condition for the existence of potential in the system management capabilities is its organization.

In the cybernetic approach the management system can function, if it contains four essential elements: channels to collect information on the state of the environment and object; the channel of impact on the object; the purpose of the management; the method (algorithm, generally) of management, indicating how to reach the goal, having information about the state of the environment and object.

A very important component in the cybernetic approach is the concept of feedback. Feedback occurs when outputs of a system are routed back as inputs as part of a chain of cause-and-effect that forms a circuit or loop [3].

There are two types of feedback: negative feedback and positive feedback. Negative feedback occurs when some function of the output of a system, or process is fed back in a manner that tends to reduce the output, whether caused by changes in the input of the system or by other impacts. Positive feedback is a process that occurs in a feedback loop in which the effects of a small disturbance on a system include an increase in the magnitude of the perturbation [1]. That is, A produces more of B which in turn produces more of A [5].

Cybernetics studies the problem of stability of the system by using negative feedback. An important feature of the cybernetic approach is that the system tends to resist changes in the environment. In the event of external influences and variances resulting from these influences, the system analyzes the results of own functioning. With using of the feedback the system generates input parameters. Feedback affects the system which as a result preserves their state and continues to function for reaching their goal.

Modern public administration operates on the principle of feedback and maintaining stability. This approach can take place at a sufficiently stable state of the environment. However, the theory of socio-economic systems, confirms the presence of cyclic processes that violate the stability of environment and stability of the functioning public authorities. That circumstance requires a different approach to governance.

A dynamic external environment and the rapid changes in the social-economic systems in the world are the fundamental factors of instability in the countries and interstate associations. The state and inter-state management systems do not have time to stabilize their functions and move on to the processes of sustainable operation. The changes require new forms of governance and changing of organizational structures.

For example, one of the main problems of the European Union is the economic heterogeneity of its members. This degrades controllability and economic sustainability and complicates decision-making. Between poor and rich countries grow economic contradictions. More than half of Europe's GDP is created, the so-called "Euro-donors" - Germany, Britain, France and Italy. Euro-donors are "pulling" the economies of less developed countries, which lead to instability in the functioning of EU. As a result, there are structural contradictions, protectionist policies, mutual distrust of the EU members, bureaucratic structures. In addition, the migration crisis and weakening the banking system become the major reasons for the difficulties in the EU today.

The main problems of Ukraine are: the low efficiency of economy, no effective system of governance, a low level of development of civil society, corruption which has turned into one of the threats to national security. Problems of economics as a coherent system are associated with the need of state support for clusters of this system, with the refinancing for the banking sector, with industries and companies that receive subsidies from the budget, obtaining through lobbyists for tax benefits. Public administration in Ukraine, despite the years of independence retains much of the components that were created under the planned economy with the involving the highest state agencies in the country's life. The level of Ukrainian citizens' participation in public and political life is not very high. The most influence from citizens on politics is only during elections. However no less important is to participate in political life in between the election, especially at the level of local democracy. All these facts confirm that the main features of national life in Ukraine are the political, economic and social

instability. Governance in these conditions is very difficult and requires other approaches than those used now.

Comparisons of EU countries and Ukraine show that the major differences lie in the countries' development levels and the ability to solve problems of public administration. However, the determining factor in generating public administration challenges is the instability of internal and external environment of states and interstate associations. It means that it is very difficult to reduce the level of variation in these conditions for effective using of cybernetic approach to governance. The maintenance of stability in cybernetic system achieves with using of negative feedback. In terms of cybernetics this feedback reduces output of governance system if variability of the system exceeds allowable meanings. Herewith degree of deviation should remain in the range of meanings that allow the governance system adjust their activity. If degree of deviation for some reason exceeds ability of governance system return in the initial state the consequences can be unpredictable. For example the decision to hold the EU referendum in the United Kingdom in 2016 resulted in impossibility return the governance system to the normal state after majority in England and Wales voted to leave the European Union. A similar situation occurred in Ukraine after the president refused to sign an agreement on association with the European Union in 2013. In the United Kingdom and in Ukraine, the events occurred with different scenarios and consequences took different forms, but in both cases there was a partial loss of controllability in public administration systems.

As it noted earlier, the traditional approach to the governance requires major efforts for maintaining invariability of the processes that occur in government system, in socio-economic, political and law systems of states and interstate associations. However, the attempt of permanent permanence retention leads to negative consequences for development of different fields of governments' activity. The attempts of fixing socio-economic system lead to slowing the rates of its development. Slowdown of development of political system leads to reducing of citizens' influence on the state power. Invariable political and legal systems lead to an infringement of the rights and freedoms of citizens. Only the constant improvement and development of all spheres of the state activity, including the public administration can maintain stability in society and to increase the living standard of citizens. It means that the term "stability" in governance refer to the processes of improvement, development, enhancement, accomplishment, perfection. These processes provide stability in all areas of society and the state. In these circumstances, the cybernetic model of governance may work that amount of time, which allows maintaining stability of the internal and external factors affecting the management system. If these factors change their values or new factors arise, the governance system must be transformed, the structure must be improved, and system has to introduce new principles and rules for governance.

In the information age, the time for the structural and functional changes decreases, the changes in governance systems become continuous. In these constantly changing conditions is necessary to have a governance system that allows responding on time changes and changes itself according to the development trends of internal and external environment. This governance system must work not as a cybernetics system, but as a complicated dynamic system that reacts on the changes and continues improve their characteristics under changing environment. This system must be developed with using of the principles and approaches which provides synergetics.

Synergetics considers internal linkages of elements of the world. It is carried out through small impacts - fluctuations. This gives the opportunity to go to other levels of the organization and can identify the linkages of different quality levels of being. Small effects can occur only in the types of environments that are able to strengthen them by using nonlinear positive feedback. Synergetics focuses on the understanding of development, self-development and self-organization of open nonequilibrium systems. An important task is the selection of synergetic areas of further evolution in the so-called bifurcation points (branch points of solutions), taking into account the constructive role of randomness in these processes. Bifurcation point is the point of branching paths of evolution of open nonlinear system. Synergetics explores substantially non-equilibrium systems, ie systems that are far

from equilibrium conditions. Also, it studies essentially nonlinear processes of evolution systems. In these processes the internal or external fluctuations can cause the system to the change. The system is not simply returned to their previous state of equilibrium. In this case, there are a variety of new, relatively stable structures.

Synergetics offers a new paradigm of nonlinearity. The nonlinearity in the mathematical sense reflects a certain kind of mathematical equations containing unknown quantities in a power greater than 1, or coefficients depending on the properties of the medium. Non-linearity in terms of worldview may be disclosed as the idea of a lot of variance paths of evolution, the idea of a choice of alternatives and the consequent idea of irreversibility of evolution. Non-linearity enables ultra-rapid development of the processes. At the heart of such a development mechanism is a nonlinear positive feedback. In synergetics is used the principle of "proliferation of small" or "gain of fluctuations." Under certain conditions, the non-linearity may intensify fluctuations and making a small distinction bigger, with the macroscopic consequences. Nonlinear systems demonstrate another important property - the sensitivity threshold. Below the threshold, everything is reduced, erased, it does not leave any traces in nature, and above the threshold, on the contrary, all multiplied [7].

For explanation of opportunity to use of synergistic approach to governance it is necessary to study concept of self-organizing systems. Economists sometimes consider the market economy as a self-organizing system. Neo-classical economists hold that central planning makes economic system less efficient. Other economists consider that self-organization produces bad results and that the state should direct production and pricing. Most economists recommend a mixture of market economy and command economy characteristics [2, 8].

Hermann Haken is considering the self-organizing society as a society in which the direct state control disappear. His place is taken the real compulsion. The struggle for survival may result to the desire for power. However, today the acquisition of power associates with formation of groups beyond the borders of the state. Instead of competition there is coexistence between different order parameters, whether it be economic systems, financial group or religion. As part of the self-organizing society the world becomes more turbulent and converts one structure to another [4].

A self-organization can't be the only one way to development of society and economics. Government regulation of the economy is necessary for economy development, and the government regulation of self-organization is necessary for the control of these processes. However, such governance should not intervene in the natural course of processes taking place according to objective laws. The governance must adapt in accordance with these laws, using synergy approach.

All real systems are open and non-linear. On the contrary the isolation and the linearity is an exception to the rule. Synergetics overestimates the role of chaos in the process of evolution of nonlinear complex systems. Every process of development is accompanied by a huge number of contingencies. They have little effect on the underlying processes. Most of the efforts are in vain, came to nothing lead. The laws of the evolution envisage the presence of a certain share of chaos and destruction. Chaos is not always evil. Small fluctuations are often significant. Randomness, fluctuation can go to the micro level and to determine the form of the general course of events. The open nonlinear medium must be in the state of instability. It means existence of sensitivity of nonlinear medium to small fluctuations that is amplified by nonlinear positive feedback mechanism.

Structures in open non-linear systems are called dissipative structures. In such a system there is always a factor of dissipation, there are disequilibrium and openness. The mechanism of self-alignment structure in the environment of the process is associated with the dissipative factor, which operates throughout the system. Attenuation of fluctuations and the randomness happens differently. Due to nonlinearity the dissipation destroys only certain kinds of fluctuations that are not supported energetically. And other kinds of vibrations are amplified due to the nonlinearity. The dissipative processes and scattering are the macroscopic representation of chaos at the micro level. Chaos is thus not a factor of destruction, it is the power that outputs to the attractor, and has the trend of structuring nonlinear medium.

For the occurrence of the effect of localization structure in an environment (system) are required three factors. First, the environment (system) should be open and accept matter, energy or information. Second, the non-linearity is needed to warrant a certain connection between the harmonics, which lead to the system sensitivity to external influences. Third, to be a factor that removes all excess move types (modes), i.e. those that are not supported by the nonlinearity effect. This may be dissipation or its analogue [10].

On the one hand, constructive, creative chaos (exit to the attractor, the trend of structuring nonlinear medium) is manifested in the destruction all "unnecessary" objects and phenomena, that on this background is clearly emerged the relatively stable structure. On the other hand, this complex structure is a relatively stable. For a long time, far from the time of exacerbation, it exists as a metastable structure. The aggravation fluctuations lead to a de-synchronization process different fragments of the complex structure and thus to its decomposition. Micro-chaos sooner or later passes to the macro level and destroys what he built. It stimulates the emergence of macroscopic, chaotic and turbulent behavior, in spite of the seemingly rigid determinism structure. Thus, the organization (structure) exists only because it is there is a finite time.

The constructive role of chaos in the self-organization is revealed in the following ways: chaos is necessary for the system output to one of the attractors, to one of the possible structures; chaos underlies the mechanism of association of simple structures in complex coordination mechanism pace of their evolution; chaos appears here as a complication of the organization and as a means of harmonization of the rates of development of the various fragments of the complex structure; chaos can act as a switching mechanism, changing different modes of the system, the transition from one relatively stable structure to another [6].

The processes of self-organization and the processes of transition of the system to one of the attractors, obviously visible in the events related to the referendum in the United Kingdom's membership in the European Union and the events leading up to the "Evromaydan" in Ukraine. In these cases, there are both two major attractors and two possible kinds of structures. In both cases, the processes of change began at the micro level and at a certain level of instability there was a transition to one of the possible ways of development. The push to the choice of development path in the case of a referendum in the UK was a slight advantage in the number of voters who voted for leaving the EU. In the case of Ukraine, the choice of development was associated with a decision not to sign an agreement on the EU-Ukraine Association. A significant difference for these events is that the UK government deliberately held a referendum, given the mood of ordinary people and the result was admitted. In Ukraine there was an attempt to resist the natural course of events and turn the system in the opposite direction, which led to tragic consequences [9].

In order to solve the complex political, social and economic problems is necessary to use a control system of open and non-linear social and economic systems with the use of a synergistic approach. This requires the monitoring of the state of open nonlinear medium by which to determine the degree of instability. It is necessary to use statistical data, which describe the state of the economy, social and political processes at both the macro and micro levels. The main objective of the monitoring is to monitor the process of de-synchronization of the various fragments of the complex structure and prognosis of exacerbation. Next, it is important to identify ways of the system on an attractor, to one of the possible structures. There are several possible ways. Governance system can use the data of macro and micro-analysis of economic and social processes identify the moment onset condition of instability, when the nonlinear medium is sensitive to small fluctuations that occur and are enhanced with using the nonlinear mechanism of positive feedback.

In the presence of the data about unstable state of the system, particularly with exacerbation, governance system can take thoughtful and good decisions that are associated with the moving of the system to the particular attractor and the creating of a preferred structure. For the implementation of the synergetic approach is necessary to develop specific governance mechanisms. Among these mechanisms are the most important: informational, economic, social, financial, legal mechanisms.

Informational mechanism is a major among other mechanisms that should be incorporated into the e-government system. This mechanism should provide a system of governance by necessary data and the results of analysis of the socio-economic system and to provide information about the possible ways of its development.

**Conclusions and suggestions.** Synergetics as science studies the processes of development, self-development and self-organization. It offers a new paradigm of nonlinearity. The nonlinearity is considered as an idea of many ways of evolution, the idea of choosing alternatives and consequently the idea of irreversibility of evolution. The nonlinearity in governance may increase the impact on the system and under certain conditions these effects can go from micro to macro level of social-economic system. For solving political, social and economic problems is necessary to use a control system of open and non-linear social and economic systems with the use of a synergistic approach. This requires the monitoring of the state of open nonlinear medium by which to determine the degree of instability. The control system can use the macro and micro analysis to determine the onset of unstable state when is enhanced the positive feedback on the system with using a nonlinear mechanism. If there is data about the socio-economic system, the control system can make thoughtful and good decisions that are associated with moving the system to a particular attractor and creating better structures. To implement synergistic approach is necessary to develop mechanisms of governance, such as: informational, economic, social, financial, legal mechanisms.

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