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Article

Economic security of states in the conditions of global changes

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Abstract: The most important issue of economic development is the question of the real reasons for the growth of labor productivity based on innovative equipment and technologies or "closing technologies", both directly and in the sphere of organization and management of economic systems. Organizational innovations can also be classified as "closing technologies". For example, the creation of strategic institution, alliances and associations capable of changing the situation in the global economy, likely World Bank (WB), World Health Organization (WHO), International association Brazil, Russia, India, China, South Africa (BRICS) etc. This approach involves the formation of fundamental innovative solutions at all levels of the management hierarchy. The imperfection of the existing ideological and methodological paradigm, ignoring the mathematical constants of the Universe when designing economic supersystems or economic systems as integral distributed systems with complex dynamics similar to natural systems, the inefficiency of institutional intervention is the main reason for the impossibility of minimizing the structural and functional instability of the state economic system. The consequence of this is systemic violations and disproportions in the economy, risks associated with changes in the structure of the world economy and a colossal difference in the level of economic security of states and the phenomenon of crisis transfer.

Keywords: crisis; economic security, closing organizational technologies; horizontal contacts; transaction costs; transdisciplinary approach

1. Introduction

The problems of ensuring dynamic growth of the economy, optimal use of resources, balance of interests in society, minimization of negative anthropogenic impact on ecology are relevant for the whole world.

Solving these problems requires constant planning of measures to adapt the system of economic security of the state to new challenges of the external environment, to changes and complications of socio-economic conditions inside the country, etc. The system of economic security of the state should be characterized as a complex system. Assessing the state, identifying problems, directions of development and bifurcation points for this complex system is possible only on the basis of a transdisciplinary approach, the theory of security science and project management (Sukhorukov and Yehorova-Hudkova, 2024).

An important property of the system is its integrity, while interconnected integral systems form a supersystem. Common to integral systems is their proportionality, harmony, due to measure or proportionality. Ignoring measure (commensurability) as the most important characteristic of systems provokes disproportions and crisis situations.

Each complex open system has three basic components: input circuit of operational closure output (Khitsenko, 2014). This is most evident in non-linear or non-Gaussian systems with self-organization properties. The task of scientific substantiation of the parameters and models of such systems becomes relevant under the conditions of a singularity in the spread of crises (Panov, 1996).

Singularity conditions determine the evolution of the crisis (Snooks, 1996) in the following stages: structural crisis—polycrisis—systemic crisis (Yehorova-Hudkova, 2022). In the conditions of the constant presence of the economies of most countries in a crisis or pre-crisis state, a shortage of many types of resources, a negative impact on the environment (Kondratjev,1989) the question of finding alternative management models, oriented to the noosphere concept of human activity, remains unresolved (Rubens,2023). Currently, humanity is faced with a growing number of various environmental problems that have negative consequences for the general system (super-system according to P.Sorokin) and all its subsystems (Sorikin, 1957). Combinations of the main properties of the system cause the emergence of an effect called the emergent effect. Thus, in the system of economic security of the state within the framework of social evolutionism, a process of self-organization or a process of growth and support of mutual coordination of system elements may arise (Sanderson, 1990).

Self-organization occurs in open unbalanced systems due to the compatible or coherent behavior of elements of dissipative structures. From the point of view of famous scientists in this field of science, the phenomenon of self-organization is connected with such a concept as chaos or dynamic chaos. In the work of I. Prigozhin and I. Stengers, the statement about two different types of manifestation of a chaotic state is presented, namely at the micro-level "dynamic formalizing chaos" and at the macro-level "dissipative constructive chaos" and the conclusion about the problems of reversibility and irreversibility is substantiated (Prigozhin and Stengers, 2001). Therefore, the period of bifurcations or crisis phenomena is practically continuous, without getting out of one crisis, humanity will enter another. This is confirmed by the consequences of the global economic crisis of 2008.

Since management is, first of all, an information process, the achievement of the goal of management (for example, a sufficient level of economic security of the state as a basis for countering the crisis) in the conditions of changes in large-scale information flows requires the use of such concepts as the full management function and the management hierarchy (Kotsko, 2022). The most effective management methodology is project management. Separate attention should be paid to the logical-structural approach in project management, which is systemic in content (Sukhorukov et al., 2022). Project or program management, like the full management function, involves an assessment of its environment, in theory it is called an assessment of the environmental factor. If the environmental factors are unfavorable, the project may be rejected or revised, because the deviation from the project goal will make the project impossible or the project performance will differ significantly from the planned or tend to zero. At the macro level, the impact of accounting for the environmental factor becomes even more significant, taking into account the scale and possible negative socio-economic consequences at the state level. Also, it should be fixed to which level in the management hierarchy the project belongs (Wołowiec and Martyniuk, 2022).

According to P. Sorokin's theory, the change of supersystems is based on the change of the prevailing truth. The concept of "supersystem", first proposed by P. Sorokin in relation to socio-cultural systems, assumes that the basis of the supersystem is a certain type of culture.

Each worldview supersystem corresponds to a certain type of culture. "If one of the systems seeks to occupy a monopolistic position and displace other truths, then the share of "false" in it increases due to the decrease of the share of true, to the detriment of the reliability of the systems." The resulting cognitive difficulties lead to social and economic problems and, ultimately, to a change in the supersystem due to disproportions and crisis phenomena at all levels of the hierarchy. The distribution of changes occurs on the basis of informational connections in the supersystem.

Novelty. The management of complex hierarchical systems, including economic ones, is studied from the standpoint of classical science, which has its own categorical apparatus and concepts; from the standpoints of synergy, which is a synthesis of classical systems theory, transdisciplinary approach, structural harmony of systems, the theory of fractals and attractors, as well as from other standpoints. It can be assumed that any supersystem or system designed on the principles of self-organization, using the mathematical constants of the world system, will be a stable system that is self-harmonizing, self-harmonizing and providing appropriate elements of the environment to other systems in the hierarchy. (Weise, 2009). Any system has its own metric characteristics. For example, P.A. Florensky notes: "The law of the golden ratio is really implemented in nature. But there are many spheres or plans for its implementation, and then the question arises about the general beginning of these proceedings" (Arefjeva, 2023).

The hypothesis of this study is as follows: when designing economic, technical and other artificial systems and aggregates of their components, one should be guided by the ratios of the golden ratio and its derivatives as components of the Law of Measure (golden ratio, recurrent series of golden ratios, wurfs, "metallic" proportions (Yegorova-Gudkova, 2014). The underestimation of these ratios leads to the violation of the principles of stability of artificial supersystems, the emergence of macroeconomic disparities, the creation of conditions for the transfer of the crisis from economically more developed countries, and the spread of crisis phenomena.

According to the law of structural harmony of systems E.M. Soroko, the structure of the system can be represented by invariants and variations. The constant of the golden section and its mathematical derivatives refer to structural invariants, attractors that should be focused on when designing artificial supersystems and their components.

The methodology and technology of building harmonious systems of a balanced economy as a supersystem should become a working tool of state management of economic processes and phenomena.

Let's consider some traditional principles of designing economic systems, which today need to be adjusted in order to acquire the properties of self-organization and self-harmonization.

2. Materials and methods

The concept of the system assumes that there is a dominance of the role of the whole over the individual, the complex over the simple. The whole is greater than the sum of its parts. The system has a structure with a certain arrangement and connection of its component parts. A system has many states corresponding to its various properties, which are described by a set of parameters. (Bogdanov, 1989) The structure of the system is the most conservative characteristic of the system in contrast to the state of the system. The system is hierarchical in structure. The properties of the system as a whole are determined not only by the properties of its individual elements, but also by the properties of the system structure as a whole. Each system has parameters that are basic or vital for it. The existence of the system depends on them. The existence of the system preserves these parameters in the process of adapting the system to external conditions and thus supports the existence of the system itself.

A complex hierarchical, non-linear, open and emergent system of the country's economy or supersystem is in conditions of constant changes that occur under the influence of the external and internal environment (Sanderson, 1990).

The system has a "conservative" part the structure and a "dynamic" part the state. The structure is less subject to change and is based on the categories of space. The state, on the contrary, is the most subject to change and is based on the categories of time.

The key characteristics of a complex system are operational closure, self-organization, self-harmonization, emergentist, and purposefulness.

In the categories of management theory, attention should be paid to such concepts as the goal vector and the deviation vector management errors that require adjustments to avoid failure to achieve the management goal. From the point of view of the authors the achievement of the goal of sustainable and safe growth of the economy, the vector of deviations is characterized by the share of the shadow economy in relation to the country's General Domestic Product (GDP).(Martyniuk, 2020).

According to the law of structural harmony of systems (Soroko, 2019) each system's structure can be represented by invariants and variations.

"An invariant is a structural attitude, a generalized quantitative or qualitative indicator that persists during some transformations, transformations, changes of the system it characterizes. Variations - system elements that change.

"When developing a management strategy or a corrective installation, when the object of management or correction is a complex, self-organizing system, it is important to distinguish what should be changed, transformed (variations), and what should remain unchanged, which will not be subject to transformation, clarification, strengthening (invariants). The invariant aspect of any system is its structure, which always has a certain level of diversity. With the help of its harmonization, the system gets an unbalanced state, which is necessary for its effective life activity. Thus, it finds an optimal mode of existence, which differs in functional quality. Generalized golden sections are invariants, based on and with the help of which, in the process of self-organization, natural systems find a harmonious structure, a stationary mode of existence, structural and functional stability.

In the works of Academician I. Prangishvili, it is shown that "the balance between disorder and order as a whole in all parameters of the system is provided by their inequality for individual parts and individual parameters. The evolution of nature corresponds to a complex change of boundaries between two equal opposites order and disorder; the increase in the orderliness of the system is caused by the increase in order according to certain parameters of the system and the increase in disorder (disorganization) according to other parameters, and not by a general transition from disorder to order according to all parameters of the system. At the same time, the stability of the system is determined by the relationship between the values, of the measure of order or disorder for the corresponding parameters according to the Fibonacci method or the golden ratio. "Perhaps there is a simple principle in nature: the greater the number of proportions of the golden ratio, the higher the level of development and the higher the possibility of expansion, and the increase in entropy reflects this process as a quantitative measure." (Prangishvili, 2006). Anti-crisis at all levels of the hierarchy of the management system should begin with the creation of a hierarchical system of economic security of the state, which is open, complex and non-linear. Large systems require a complex, interdisciplinary approach, as is clearly seen in cybernetics, systems engineering, the sciences of the Universe and the Earth, etc. (Bogdanov, 1989). That is why the scientist is more and more often forced to resort to generalized, enlarged models and programs, and with them to images, as a means of such enlargement.

Thus, the system of economic security is an open system, has its own specific structure, this system accumulates information "produced" on the basis of interactions existing in market conditions.

The use of information should affect the change of the strategy of economic security and its components, and the change of strategy is always connected with the change of the structure of the system (Samusevych, 2023). The system of economic security is under. organizational influence from the state. Economic security as a system has the properties of self-organization. The rationality of the combination of organizational influence and self-organization lies in optimizing the ratio of such system characteristics as stability and efficiency.

By system stability, we mean "the ability of a dynamic system to maintain movement along the intended trajectory (maintain the intended mode of operation). The main types of stability are equilibrium, homeostasis, stationary mode (cyclic repetition of the same sequence of states)". By efficiency, we understand the quantitative characteristic of the result in its result-cost form (Grinko, 2020).

The optimal combination of organization and self-organization in the system of economic security appears in the form of economic efficiency and stability, both of the system as a whole and of its structural elements (Krjuckova, 2005).

One of the main tasks of economic security should be to ensure the structural and functional stability of the system, its proportionality. The structural harmony of the object is related to the presence of opposites in the system. "The great map of the optimal states of nature, (Soroko, 2019), according to which it creates its orders, is written in the language of opposites, contradictions and oppositions."

"Structural harmonization of a complex whole, taking the form of self-organization, is directly related to its restructuring—redistribution of the weights of structural elements, subunits, subdivisions, their relative contributions, significance, roles, functional duties, positions, internally acquired organizational statuses, etc. p. To carry out such transformations and preservation, we again find a state the maintenance of a stationary mode of self-reproduction of the integral quality of the whole requires an additional influx of resources, material costs, intensification of energy exchange." The law of structural harmony of systems by Eduard Soroko envisages such two groups of system characteristics as invariants and variations. "When developing a management strategy or corrective setup, when the object of management or correction is a complex, self-organizing system, it is important to distinguish what should be changed, transformed (variations), and what should remain unchanged, which will not be subject to transformation, clarification, strengthening (invariants)".

What is an invariant, what is the meaning of this concept? An invariant is a structural parameter, a generalized quantitative or qualitative indicator that is preserved during the transformations and changes of the system whose structure it characterizes.

E: Soroko: "The term invariance means stability, immutability. At the same time, we are talking about stability against the background of some general and various fluctuations". Invariants always coexist with variations.

This study used the and invariants variation approach of self-organized complex systems for examining the effects of the crisis and its factors and for examination the multifaceted impact of organization innovation or "closing organizational technologies". Up to our point of view, "closing technologies" can be broadly divided into two groups: technologies proper, such as cold nuclear fusion, which, due to their innovativeness, make previously existing technologies unnecessary or "close" them as incomparably less effective. And the other group is organizational "closing" technologies related to management, vertical and horizontal integration, creation of new institutions and instruments capable of influencing global economic security. For example, such institutions are the World Bank, the Federal Reserve System, the World Monetary Fund, the WTO, the WHO and other similar organizations and agreements. In the context of global changes and the formation of new horizontal connections in order to improve management efficiency and reduce transaction costs in the economy (in development of the theories of such Nobel laureates as Elinor Ostrom and Ronald Coase), new institutions arise, such as BRICS and related new structures, whose activities will compete with existing institutions and influence the state of economic security in the world. Also, the system of new horizontal links will influence the possibilities of crisis transfer (Sukhorukov, 2004) and, accordingly, will have a positive effect on reducing transaction costs in the global economy. With current anti-crisis management, it is necessary to pay special respect to the targeted and systemic actions of countries that have interests in Ukraine and will promote expansion in our market. Extended edges to increase your economic security and consolidate competitive advantages create a "transfer crisis" by A. Sukhorukov (**Figure 1**). Transfer crises are ensured by offensive mechanisms: pressure through international financial organizations; export of old products and technologies; unscrupulous behavior of foreign investors; extraction of natural resources; polishing of unprotected intellectual products; disparity in trade in high-tech goods; discrimination in foreign trade; provoking financial crises (Sukhorukov, 2009).

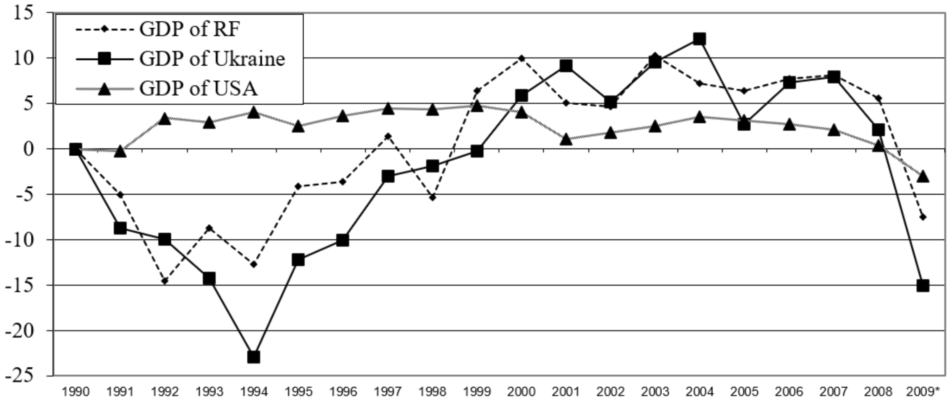

Figure 1. Crisis Transfer (pace % to the previous year).

According to the authors of the article, counteracting the transfer of the crisis is possible on the basis of organizational innovations, which include the formation of various horizontal links (Ostrom, 1989) in the system of global economic security and the creation of new international institutions (Ostrom, 1990) with planned properties of ensuring stability, reducing transaction costs (Coase, 1995). and de-shadowing (Soto, 1989). Such institutional formations and organizational innovations can be classified as a group of "closing organizational technologies." This, in turn, can become the basis for de-shadowing the economy (Denysenko and Breus, 2014) and reduce the cost of using the market mechanism (Arrow, 1995; Nort, 1997).

According to the theory of self-organization and harmonious development of systems (Soroko et al., 2018) and its economic interpretation (Yegorova-Hudkova, 2014), monetary units (invariants-variations approach) used in settlements are replaceable instruments, depending on the state and scale of the economic system that issues them; on the provision of this system with its own resources, on the availability of an effective production base, and other invariants and variations. See **Table 1**. New monetary units, traditional and digital, can become instruments for ensuring new horizontal links. The following paragraphs describe the research design, data collection methods and analytical approaches taken to comprehensively examine the impact of the current global economic crisis worldwide.

Table 1. The invariants and variations of the economic security system of the state.

The invariants of the economic security system of the state	The variations of the economic security system of the state
1. Share of state property	1. Monetary unit
2. Internal market	2. Quality of management
3. Technological structure	3. Market transparency
4. Gross domestic product	4. Openness of the economy
5. Unemployment	5. Raw material export
6. Inflation	6. High-tech export
7. Transaction costs	7. Import substitution
8. Demographic security	8. Budget benefits
9. Education system	9. Salary arrears
10. Health care system	10. Deficit of funds of the pension fund
11. Food safety	11. Debt from utility payments
12. Financial security	12. Loan interest rate
13. Foreign debt	13. The level of monetization of the economy
14. Depreciation of fixed assets	14. Digitization of the economy
15. Tax system	15. Participation in international financial institutions
16. Shadow economy	16. Participation in TNC
17. Share of added value in finished products	17. Participation in strategic alliances and partnerships

2.1. Research design

The research design was crafted to provide transdisciplinary approach and invariants variation approach of self-organized complex systems for examining the effects of the crisis and its organizational factors and influence to sustainability of economic system.

Table 2. Expenditure structure according to the state budget of the USSR (billion rubles in comparable prices).

Articles of expenditure Size	Period A 1964	Period B 1965 1966 1967 1968 1969	Period C 1983 1984 1985 1986 1987
National economy	45.0	45.2 44.8 44.4 46.6 46.1	59.7 60.1 60.4 60.5 60.2
Soc.cult. activities	38.2	39.9 40.4 40.6 38.8 39.1	34.4 34.2 33.6 33.8 34.2
Defense	15.5	13.7 13.4 13.7 13.3 13.5	5.1 4.9 5.2 4.9 4.9
Management	1,3	1.2 1.4 1.3 1.3 1.3	0.8 0.8 0.8 0.8 0.7
$\hat{H}$ Indicator	0.774	0.758 0.761 0.761 0.756 0.758	0.624 0.620 0.623 0.618 0.617
Measure node $\hat{H}$	0.778 (k = 6)	0.755 (k = 5)	0.618 (k = 2)

The sustainability of an economic system can be assessed in various ways: based on the analysis of macroeconomic indicators (1); based on the calculation of the relative information entropy indicator (2), which is an integral indicator and characterizes the state of the system as a whole. See Equation (1) by Shennon (1948) and **Table 2** by E. Soroko. Also, if the calculations are large enough and the system has the property of stability, then graphically we can obtain an image of the Lorenz attractor (3) (research by Stefania Vitali, James B. Glattfelder, Stefano Battiston). See **Figure 2.** The next option for assessing the state of the system is to compare its characteristics with the values of fractal-cluster constants (4) (Burdakov and Volov, 2015). (The basis of the analysis proposed in p. 2, 3 and 4 are the universal mathematical constant - the Phidias number (golden section) and its derivatives).

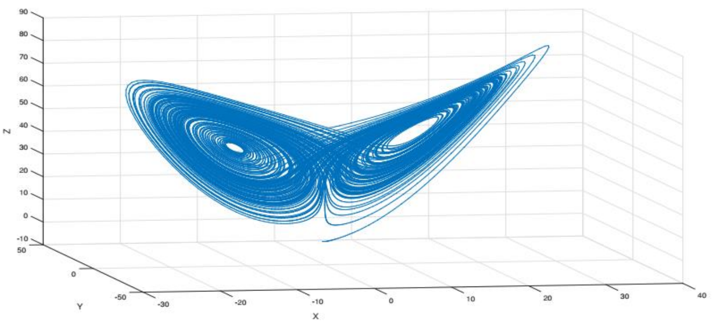

Figure 2. Lorentz attractor.

2.2. Data collection

The data for the article were collected on the basis of statistical materials presented in scientific publications, monographs, journals, analytical collections of authorized organizations, as well as analytical reviews presented on the Internet.

2.3. Analytical approach

Based on the main objectives of our study, which are to analyze the invariants variation of self-organized complex systems (Soroko et al., 2021) we study the most important invariants and variations, the state or change of which can influence the change in the level of economic security of the countries of the world. The set of invariants can be supplemented on the basis of innovative changes occurring at the meso-level, both theoretical and practical. For example, the discovery of a new attractor regarding the organization of systems and the design of their properties, the introduction of new theoretical areas of system design based on econophysics, tribophatics, digitalization, blockchain, cibermoney and other innovation etc. Sa result the variations can change constantly. The concept of innovative development, the change of the "dominant truth" (Sorokin, 1957), the transition to a new technological order is associated with such a phenomenon as "closing technologies", which can become the core of a new technological order or structure. And if earlier "closing technologies" were developed mainly in the military-industrial complex and related industries, now organizational technologies can be classified as such. For example, technologies that change the existing banking system and almost completely replace it.

The generalization and systematic analysis of the theoretical and methodological foundations of the theory of security science in connection with the provisions of the theory of synergy provide the opportunity to improve some provisions of the theory of security science itself, since ignoring the invariant-variational structure and the ineffectiveness of existing institutional intervention are the main factors of the inability to minimize structural and functional instability and as a result to counteract the emergence and spread of crisis phenomena, the transfer of the crisis and the shadowing of the economy (Yehorova-Hudkova, 2021).

For example, the transdisciplinary approach in management as a basis for countering the crisis can be traced on the example of the activities of TNCs. The analysis of the activity of TNCs shows that they are less affected by the crisis than any other integrated hierarchical structures, they increase the pace of production the fastest even in crisis conditions, they increase the innovative level of production at the fastest pace and have a high level of financial stability (Vitali et al., 2011). All signs of self-organization and self-harmonization are present.

3. Results and discussion

Regarding the above, we believe that the any complex economic system or super system as open system can be structurally represented as a set of invariants and variations.

Let's consider the proposed version of the composition of the set of invariants and variations of the economic security system of the state, which is justified on the basis of the analysis of the legislative environment, official information sources, statistical reporting regulations and scientific literature on the theory and practice of security studies.

According to Shannon (1948), the assessment of the state of the system with self-subordination properties can be determined by calculating the relative information entropy an integral indicator, the values of which mathematically correspond to the generalized golden sections or unit fractions. Entropy becomes an expression of the amount of information related in the distribution of system components. Normalized to a unit, that is, taken to its maximum value, it can be calculated as:

$$\bar{H} = -\frac{1}{\log n}\sum_{i=1}^{n} p_i \log p_i \qquad (1)$$

where n is the number of system components

The ontological status of the measure and information entropy, the nodal value of which corresponds to the best options for solutions or optimization, ensuring the stability of the system based on the principle of diversity, should be carefully studied on the example of various economic systems, including the system of economic security of the state.

The principle of diversity entered science through the concept of information. In 1948, C. Shannon and U. Weaver developed an information-theoretic basis for assessing system diversity, the concept of "information", if used in a broad sense, successfully replaces such definitions as "amount of diversity" or "specificity". Speaking about the stability of complex systems, it should be noted that this implies non-equilibrium stability. This is inherent in all systems in which some exchange processes take place on a permanent basis (in stationary mode), as a result of which its structural and functional renewal takes place. In stationary conditions, the increase in entropy reaches a minimum in it, and the increase in the degree of organization redundancy increases to the maximum. Being a measure of chaos, structural diversity, the maximum of which is reached at $\overline{H} = 1$ in the state of equilibrium of the system (that is, when the weights pi of its structural components are equal), it is additional to the measure of organization, order, uniformity R and Место для формулы.satisfies the law of conservation together with it: $\overline{H} + R = 1$.

According to Prigozhin's theorem, outside the equilibrium of the system, entropy can reach a minimum increase, and its antipode R a maximum, (Prigozhin, Stangers, 1994). Speaking about the stability of complex systems, for example, the system of economic security of state (SESS), it should be noted that this implies non-equilibrium stability. This is inherent in all systems in which some exchange processes take place on a permanent basis (in stationary mode), as a result of which its structural and functional renewal takes place.

In stationary conditions, the increase in entropy reaches a minimum in it, and the increase in the degree of organization redundancy increases to the maximum.

The process of objectively reaching the structure of the attractor of financial assets, divided into different items of the budget, it is important to promptly and appropriately adjust the structural and financial field associated with it teak of the state. Let's take a look at **Table 2**.

Table 2 shows how, passing through intermediate phase states, from period A to period B, which are characterized by certain nodal values of the integral measure, the economic system "Budget of the USSR" in its expenditure part in the process of evolution objectively seeks to find such a distribution of components for which this measure is equal to the nodal value of 0.618 (Phidias figure or Golden Section). It is the most natural since it satisfies the Euclidean metric. Note that the specific weight of the structural dominant of the distribution "Expenditure on the national economy" also approaches this nodal value.

In natural systems, the self-organization of complex systems occurs in the form of self-harmonization, for example, the phyllotaxis system, as statistically and spatially distributed, where measure nodes, generalized golden sections visually reveal the properties of the attractor.

To illustrate the structural dynamics of society, in which the golden ratio naturally and objectively reveals its attractive properties, let's take an example from the economic situation of the USA (**Table 3**).

Table 3. Structural transformations of the US economy and the evolution of its integral characteristic - relative entropy.

	Number of employed, %				**Informational entropy $\hat{H}$ as integral measure**
Year	**Agriculture**	**Material production**	**Service sphere****	**Unemployed**	**Actually/ (canon attractor)**
The period of the Great Depression					
1929	21.1	38.7	37.1	3.1	0.845
1931	20.3	31.0	32.9	15.8	0.967
1933	19.5	26.9	28.9	24.7	0.993 (max)
1934	18.9	29.2	30.3	21.6	0.986
1940	17.0	33.5	35.0	14.5	0.949

Table 3. (*Continued*).

	Number of employed, %				Informational entropy $\hat{H}$ as integral measure
Year	**Agriculture**	**Material production**	**Service sphere****	**Unemployed**	**Actually/ (canon attractor)**
The period of the 2nd World War and the post-war years					
1942	15.3	37.8	42.5	4.4	0.834
1943	14.1	35.8	48.4	1.7	0.769
1944	13.6	34.1	51.3	1.0	0.741
1948	12.3	39.6	44.4	3.7	0.799 (0.797)
1951	10.5	39.5	46.8	3.2	0.771 (0.778)
1954	9,4	37.5	47.7	5.4	0.794(0.797)
1955	9,6	38.2	47.9	4.3	0.779 (0.778)
1958	8,0	36.9	48.5	6.6	0.794 (0.796)
The period of the beginning of economic growth					
1962	6,8	36.7	51.1	5.4	0.758 (0.755)
1965	5,7	36.4	53.5	4.4	0.724 (0.725)
1968	4,7	34.4	57.4	3.5	0.683 (0.682)
1973	3,8	32.6	58.8	4.8	0.684 (0.682)
1978	3,3	30.3	60.4	6.0	0.684 (0.682)
1980	3,1	28.7	61.2	7.0	0.687 (0.682)
1984	2,9	27.6	62.1	7.4	0.683 (0.682)
The period of stabilization of economic growth					
1988	2,6	25.5	66.5	5.4	0.629 (0.618)
1989	2.5	24.8	67.5	5.2	0.618 (0.618)
1994	2.6	22.5	68.9	6.0	0.617 (0.618)

* Includes: industry, mining, construction, etc.
** Includes: service industry, finance, insurance, home ownership, trade, transportation, public housing, state and federal services, military.

The **Table 3** shows that during the Great Depression, the indicator the relative entropy of a given distribution of structural groups of living labor was the closest to unity, since the structure was characterized by the maximum proximity to the equality of weights of its components, which corresponded to the minimum of functional, production potential, and therefore and maximum chaos engulfed the society (Soroko, 2019).

War years (1941–1944) although the economy is progressing, but it is ambivalent, with jumps "back and forth" at a rather low economic potential and the level of exchange in society as a social organism. It is still deeply disharmonized: the relative entropy, as an integral characteristic of its structure, gravitates towards the antinodes of measures far from the optimum from the invariant of 0.618.

In the post-war years (1948–1958), the social organism of American society is in a state of "cold war" and "trembles". The economy is structurally and functionally still ambivalent. It alternately experiences jumps of growth and loss of quality, moving back and forth, then falling behind, then moving forward in a chain of constant oscillations, quantized. The next decade, from the beginning of the 60s, is a clear progressive growth, a chain of quantized transitions from one level of intensity of its vital manifestation to another, higher one. From 1968 to 1984 staying in a steady state, which is characterized by the penultimate in the series, the pre-optimal node of the measure 0.682 (Golden Section). And, finally, since 1988 the acquisition of an evolutionarily mature state of harmony with maximum opportunities for revealing one's own potential and the flow of exchange processes in an effective functional mode.

Calculations confirm the value of the integral indicator, information entropy, as a node of measure.

Complex dynamic systems are divided into dissipative and conservative systems and systems with mixed dynamics (Yehorova-Hudkova, 2021). A dissipative system, for example the system of economic security of the state, is characterized by the existence of a strange attractor (invariant) in it, which gravitates to a closed invariant set that lies and absorbs it in the phase space of the system inside the region, which includes all trajectories that cross its boundaries. The basis of the functioning of a dynamic system is feedback and multiple repeatability. The result of the functioning of such a dynamic system is a fractal (Soroko et al., 2018).

In 1963, E. Lorentz discovered an attractor, later named after him, which can be an example of a model of dynamic chaos. It is called the strange Lorentz attractor. Any complex economic system, including a hierarchical system of economic security, is open and moves towards an increase in entropy or an increase in the degree of chaos. If the functioning of the system becomes unmanageable, the conditions for the emergence of crisis situations are formed. Knowing the system parameters and managing them, you can take measures to return the system to normal mode. Attractor is also understood as the aspiration of the system to a relatively stable state in the phase space (Lorenz, 1995).

The model is described by a system of three differential equations. Graphically, the display has the shape of a butterfly (**Figure 2**).

According to the point of view of Kurdyumov and Knyazeva (2005), the attractor in synergy indicates a stable structural and functional state of the system. At the same time, the entire set of trajectories of the developing system will tend to this steady state, or structure. "Strange attractor the Lorentz attractor is most characteristic of self-organizing systems. Such attractors have a prognostic horizon or corridor with a period of prediction of system behavior. The space of the strange attractor has a fractal structure and this also extends the possibilities of prediction (Lorentz, 1995). Strange attractors are described by irrational numbers, or Fibonacci numbers, which is a manifestation of the Golden Ratio. Strange attractors exist as a result of the existence of "negative" and "positive feedback" in the system. When the system states are characterized by strange attractors, it becomes impossible to determine their position and behavior at each given moment, although one can be sure that the system is in the attractor zone and harmonization are present.

In 2011, researchers from the Department of System Design at the University of Zurich published a unique study of the structure of the Transnational Corporation (TNC) control network and its impact on the world market. The researchers found that TNCs form a giant "tie" structure, and that much of the control is vested in a small, tightly knit core of financial institutions. The study was started with a list of 43,060 TNCs, the resulting TNC network includes 600,508 nodes and 1,006,987 ownership links. The network consists of many small connected components, but at most 3/4 of all nodes contain the leading TNCs with an economic value that accounts for 94.2% of the revenue from the total number of operating TNCs (Vitali et al., 2011).

The largest number of relationships contains only one dominant strongly connected component (1347 nodes). Thus, the TNK network has a "bow tie" structure. The researchers found that only 737 top owners accumulate 80% control over the value of all TNCs.

The study found that almost 4/10 of the control over the economic value of the world's TNCs is exercised through a complex web of ownership relationships by a group of 147 TNCs, which basically have almost total control over the network. Thus, the core's top owners can be seen as an economic "super-entity" in a global network of corporations. An important additional fact at this point is that ¾ of the core are financial intermediaries.

The "strange Lorentz attractor" (Lorentz ,1993) was obtained by the researchers as a characteristic of the TNC network as a complex open nonlinear system. (Attractor is directing of the system to the relatively stable state in phase space).

From the point of view of the theory of synergy, this axiomatically confirms the presence of self-organization processes in the economic system of TNCs and the many proportions of the golden section in the economic relations of the system of interaction of TNCs with their core.

With the help of calculation algorithms of the strange attractor, science is able to describe a lot of phenomena, including the phenomena of "closing technologies", organizational and technical etc.

In continuation of replenishing the set of tools of the invariants-variations approach and new methodology of nature-like management, it is necessary to present the discovery of Burdakov and Volov (2015), according to which, in any complexly organized system, as in an organism, regardless of its subject specifics technical-technological, biological or social the internal load of the processes of resource life support is a self-similarity, has a fractal nature based on the invariant of the golden section. The authors singled out a fundamental set of indicators of the functioning of a complex system, which, thanks to exchange processes, is a stable and cyclical organism that renews itself. These indicators are combined in the form of five clusters and a subcluster (see **Table 4**):

1. Energetic (38%)

1.1. Energy resources of the body (14.44%)

1.2. Energy supply of transport (10.26%)

E 1.3. Energy protection (safety) of the body (6.08%)

1.4. Energy supply of production functions (4.94%)

1.5. Power supply of informatics (2.28%)

2. Transport (27%)

2.1. Transport resources of the body (7.29%)

2.2. Energy transport (10.26%)

T 2.3. Transportation security (4.32%)

2.4. Production transport support (3.51%)

2.5. Transport support of informatics (1.62%)

3. Security (16%)
3.1. Resources for ensuring the safety of the body (2.56%)
3.2. Transport safety (4.32%)
3.3. Security of body energy (6.08%)
3.4. Production safety (2.08%)
3.5. IT security (0.96%)
4. Production (13%)
4.1. Production resources of the body (1.69%)
4.2. Production maintenance of transport (3.51%)
P 4.3. Production (technological) protection (2.08%)
4.4. Production support (maintenance) of the energy industry (4.94%)
4.5. Production support of informatics (0.78%)
5. Informational (6%)
5.1. Information resources of the body (0.36%)
5.2. Transport information support (1.62%)
5.3. Information Security (0.96%)
5.4. Production information support (0.78%)
5.5. Information provision (maintenance) of the energy industry (2.28%)

Accordance to Burdakov and Volov (2015) these clusters characterize the distribution of resources in complex systems as organisms (including biological, technical-technological and social systems) according to the following fundamental categories or positions: Energy (E) Transport (T) Security (B) Production (P) Information (I).

For example, for a social organism, the structure of energy resource costs (E) in percentage terms looks as follows:

- Information provision of energy (2.28%)
- Production service of energy (4.94%)
- Ensuring security of energy (6.08%)
- Transport energy maintenance (10.26%)
- Energy resources, i.e., water, light, heat, food, fodder, electricity, oxygen, motor fuel, fuel for thermal power plants, nuclear power plants, etc. (14.44%)
- Energy supply of transport and exchanges (10.26%)
- Energy supply of security (6.08%)
- Energy supply of production (4.94%)
- Energy supply of informatics (2.28%)

If we sum up all these values, the result will be 61.56 (%) or Phidias constant and it’s confirmed the hypothesis of possibility to project the stable economic systems with self-organizational and self -harmonization qualities (Yehorova-Hudkova, 2021).

Table 4. Matrix of fractal-cluster relationships of a social organism.

Re =38%	Re = 14.44% Energy resources (water, light, heat, food, fodder, electricity, motor fuel, oxygen)	Rтe = 10.26% Transport service of the energy industry	Rse = 6.08% Ensuring energy security	Res = 4.94% Production support of energy	Pis = 2.28% Information support of energy industry
Rт = 27%	Ret = 10.26% Energy supply of transport	Rtt = 7.29% Transport resources (all types of movements and exchanges)	Rest = 4.32% Production support of transport and exchanges	Rpt = 3.51% Production support of transport and exchanges	Rit = 1.62% Information provision of transport and exchanges
Rs = 16%	Pess = 6.08% Energy supply security	Rtss = 4.32% Transport supply security	Rs = 2.56% Security resources (army, police, health care, etc.	Rps = 2.08% Manufacturing security	Riss = 0.96% Information supply security
Rp= 13%	Resp = 4.94% Energy supply production	Rtsp = 3.51% Transport support production	Rsp = 2.08% Security of production	Rpc = 1.69% Production and construction resources	\Risp = 0.78% Information supply of production.
Ri= 6%	Resi = 2.28% Energy support of informatics	Rtsi = 1.62% Transport support of informatics	Rsis = 0.96% Security support of informatics	Rpis = 0.78% Production support of informatics.	Rin = 0.36% Resource support of informatics
R = 100%	Re = 38%	Rt = 27%	Rs = 16%	Rp = 13%	Ri = 6%

As a result, the entire set of indicators of the necessary (functional) resource or "Matrix of fractal-cluster relations of the social organism" (Burdakov and Volov, 2015), is set by the following weight values for the selected factors of life support (%): E = 61.56; T = 26.19; B = 8.64; P = 3.24; And = 0.37. The relative information entropy calculated from these specific gravity quantities is: H = (0.2987 + 0.3509 + 0.2116 + 0.1111 + 0.0207)/log5 = 0.617—Phidias figures.

Let us consider BRICS as an institution of horizontal connections or a "closing organizational technology" for the development of the global economy and counteracting the transfer of the crisis.

Quantity of countries-members are 9, quantity of candidate for membership – 12 (on 24 October 2024).

Total GDP more than a third part of the world's GDP.

Population 45% of world population

Reserves 45% of world oil reserves

In the context of favorable development of the BRICS project and digitalization of the economy, it is quite possible that a new variation, a new monetary unit, will emerge.

4. Conclusion

The Phidias number constant (golden section) and its mathematical derivatives are related to structural invariants, attractors, which should be oriented when designing artificial supersystems and their components. The stages of the supersystem design methodology can be as follows:

1) Assessment of the status of the system (for example the system of economic security of the state, the system of the interstate alliance, for example, BRICS, etc.).

2) Evaluation of the time interval between the occurrence and satisfaction of the need (in the creation of a specific system).

3) Assessment of the structural and functional state of the existing system or forecasting of the parameters of a sustainable system being created.

4) Assessment of the level of vertical integration of business in terms of industries and sectors of the economy and the share of added value in GDP for the countries of the system that plan to join the alliance;

5) Assessment of the development of the system of horizontal connections in the countries of the alliance and the institutional state of the countries;

6) Assessment of the level of transaction costs for countries of the system that plan to join the alliance;

7) Comparison of evaluation results with attractors representing a recurrent series of golden ratios: 0.500 ...; 0.618 ...; 0.682 ...; 0.725.

8) Control of reliability and viability of the system (estimation of deviations).

9) Entropy testing of the system (relative information entropy calculation) for countries planning to join the alliance

10) Formulation of the system restructuring (reengineering) project using fractal-cluster constants if necessary.

11) Implementation of the project and evaluation of the compliance of the designed system for structural and functional compliance with the constant of the Phidias number and its derivatives.

BRICS is an example of a modern "closing technology" that changes the old economic order and forms a new global economic and security system and create the positive possibilities of social-economic development for countries and Humanity.

5. Policies suggestion

Presented below is a preliminary collection of policies that warrant consideration**:**

Invest in improving digital infrastructure, including widespread internet access and the availability of digital devices, to bridge the digital divide among students across urban and rural areas.

Invest in improving of transdisciplinary approach and project management at high schools and Universities. Collaborate with private stakeholders to provide affordable and accessible technology solutions for remote learning.

Implement extensive training programs for educators to enhance their proficiency in transdisciplinary methods, digital tools, and virtual classroom management.

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References

A. D. Panov. The crisis of the planetary cycle of Universal history and the possible role of the SETI program in post-crisis development. URL: http://lhfml.sai.msu.ru/SETI/koi/artikles/krizis.html

Alla Grinko, Nataliia Havrylenko, Tetiana Kostash, Yuriy Fed'kovych,Mariia Plekan, Svitlana Breus. Organization of a strategic management accounting in an innovative economy. Academy ofAccounting and Financial Studies Journal Volume 24, Issue 5, 202011528-2635-24-5-598

Arefjeva A.Yu. The synthesis of mysticism in the works of Pavel Florensky is an ambush for the description of scenic synthesis in the culture of the 20th century. Newsletter of the National Law University named after Yaroslav the Wise. 2023. No. 3 (58). Series: philosophy, philosophy of law, political science, sociology. P.84-91.

Arkadi Sukhorukov, Tetiana Yehorova-Hudkova, Olha Sukhorukova, Yurij Neustroev, Nataly Zghadova, Yurij Rabotin Economic security of state: diagnosis, design and stability of system. Ad Alta. Journal of interdisciplinary research. 2022. Special Issue (12/02-XXX). R. 81 – 86.

Arkadi Sukhorukov, Tetiana Yehorova-Hudkova. Planning to counter systemic crisis: project management, economic security and transdisciplinary approach. Sustainable development – the 21st century. Discussions 2023 (scientific readings named after Igor Nedin): materials of the VIII international scientific-practical conference, Kyiv, November 16-17, 2023. Kyiv, 2024. pp. 34-45. Electronic edition. (DOI:10.13140/RG.2.2.33528.25602).

Arkadi Sukhorukov. International economics: security of economic system and transboundary crisis /Confrontation and Cooperation: 1000 years of Polish-German-Russian Relations, vol.V, Anna Garczewska, Krzysztof Garczewski (editors), Berlin, Toruń - Warszawa, 2019. - P. 35-44. URL: https://content.sciendo.com/view/journals/conc/5/1/conc.5.issue-1.xml

Arkadi Sukhorukov. Study of economic security of countries on the background of recent crises – COVID-19 and war in Ukraine. Discussions 2023 (scientific readings named after Igor Nedin): materials of the VIII international scientific-practical conference, Kyiv, November 16-17, 2023. Kyiv, 2024. pp. 34-45. Electronic edition. (DOI:10.13140/RG.2.2.33528.25602).

Arrow K.J. Collective Choice and Individual Values, (2004) pp. 204.

Bogdanov A.A. General Organizational Science. Tectology. Book 1. (1989) pp. 320

Burdakov, V.P., Volov V. T. Fractal-cluster similarity of organisms and the "golden section": URL: http: //www.trinitas.ru/rus/doc/0232/009a/02321257.htm.

Coase R.G. The Nature of the Firm (1995) pp. 38.

David Rubens. Strategic risk and crisis management. London, (2023). pp.338.

Elinor Ostrom. A Behavioral Approach to the Rational Choice Theory of Collective Action. The American Political Science Review Vol. 92, No. 1 (Mar., 1998): 1-22.

Elinor Ostrom. Governing the Commons: The Evolution of Institutions for Collective Action. New York: Cambridge University Press. (1990) pp.343.

I. Prigozhin. The end of uncertainty. Time, chaos and new laws of nature.Monograph. Izhevsk: NDC "Regular and Chaotic Dynamics", 2001. 181 p.

I. V. Prangishvili, F. F. Pashchenko, B. P. Busygin. Systemic laws and regularities in electrodynamics, nature and society,2006 Eduard Soroko, Tetyana Yegorova-Gudkova, Andriy Krigin. Innovative control of space in the minds of designing nature-like folding systems: self-organization and metric stands. Control and management in folding systems: material. XV Mizhnar. scientific-practical Conf., m. Vinnytsia, 16 zhovtn. 2018 VNTU, 2018. URI http://ir.lib.vntu.edu.ua/bitstream/handle/123456789/22758/134.pdf?sequence=1 Ibid.

Khitsenko V.Є. Self-organization: development of theory and prospects for social programs. http://captador.livejournal.com/233506.html

Knyazeva O.M., Kurdyumov S.P. Foundations of synergy. Synergistic vision.2005. 240 p. (Synergy from the past to the future)

Kondratiev N.D. Problems of economic dynamics. Monograph. Moscow 1989. 128p

Kotsko T. A. Modernization of the enterprise as a prerequisite for ensuring its competitive development. / T. A. Kotsko, T. Maltsev // Eastern Europe: economy, business and management. 2022. No. 35. P. 105-112

Kryuchkova I.V. Macrostructural factors in the development of the Ukrainian economy and the Law of the Golden Cut. Economist. No. 9. 2005.P. 32-49.

Lorenz E. N. The essence of chaos. University of Washington Press (1995)

Lorenz E. Nonlinear Dynamical Economicsand Chaotic Motion. Springer, Berlin, 1993. 248 p.

MP Denysenko, SV Breus. The shadow economy as a factor in reducing the level of economic security of the state. In book: Strategic priorities of the detinization of the economy of Ukraine in the system of economic security: macro and micro dimension: Monograph. Under the editorship Cherevka O.V. Cherkasy,: 2014. 442 p. PP.336-351

Nort DK. Institutions, Institutional Change and Economic Performance (1997) pp.180.

Pitirim. A. Sorokin. Social and Cultural Dynamics: A Study of Change in Major Systems of Art, Truth, Ethics, Law and Social Relationships... Extending Horizons Books; Revised edition. 1957. 720 pp.

Prigozhin I.R., Stengers I. Time, Chaos, Quantum. Monograph. Moscow: Progress, 1994. 263 p.

Sanderson S. Social Evolutionism: A Critical History. Oxford: Blackwell, 1990; Idem. Social Transformations: A General Theory of Historical Development. Blackwell, 1995.

Shannon C.E. A Mathematical Theory of Communication. Bell System Technical Journal, 1948.T. 27. C. 379-423, 623–656.

Snooks G. The Dynamic Society: Exploring the Sources of Global Change. Routledge, 1996; Karelov S. The Great War cannot be avoided. Access mode: URL: https://uainfo.org/blognews/1483992301-bolshoy-voyny-ne-minovat.html/

Soroko E. M., Yegorova-Gudkova T. I., Tsai Bei. Formation of a financial model of economic growth: world, extinction and mathematical constants. Science Vidannya. Collection of scientific theses V International Scientific Research. conference, Financial system of the region: Trends and prospects for development, Ostrog, 11-12 June 2018. Graduate of the National University “Ostrozka Academy”, 2018. P.62-64 URL: https://nubip.edu.ua/sites/default/files/u295/s_437_tezy_fin_systema_2018_web.pdf

Soroko E.M. Golden sections, processes of self-organization and evolution of systems: Introduction to the general theory of harmony of systems. M.: LIBROKOM, 2019. 6-th edit. 264 p.

Soto Ernando de. The Other Path: The Invisible Revolution in the Third World, 1989

Stefania Vitali, James B. Glattfelder, Stefano Battiston. The network of global corporate control. arXiv:1107.5728v2 [q-fin.GN] 19 Sep 2011. Chair of Systems Design, ETH Zurich, PP.1-36.

Sukhorukov A.I. Anti-crisis policy of developed countries. Economy of Ukraine. 2004. No. 8. pp. 16-27

Sukhorukov A.I. Influx of structural damage to the safety of economic systems. Steel rose – XXI century. Discussions 2020: count. mon. NAUKMA. per ed. E. Khlobistova. Kiev, 2020. pp. 67-75.

Sukhorukov A.I. Synergetic model of the economic security system of the state. Steel developments – XXI century: management, technologies, models. Discussions 2015: count. mon. per ed. E. Khlobistova. Cherkassy: view. Chabanenko Yu.A., 2015. P. 84-96.

Sukhorukov A.I. System of economic security of the state. National Institute for International Security Problems under the RNBO of Ukraine. K. Stylos, 2009, pp. 194–204.

T. I. Yegorova-Gudkova Anti-crisis: infusion of project management, planning and marketing research. Market economics: current theory and practice of management, Vol. 21 No. 2(51), 2022, pp. 40-41, Ibid.

T. Wołowiec. W. Martyniuk. Local tax strategy and its components and the formation of investment competitiveness of the municipality // Biuletyn Stowarzyszenia Absolwentów i Przyjaciół Wydziału Prawa Katolickiego Uniwersytetu Lubelskiego t. XVII, 19 (2) 2022, s. 239-257.

Volodymyr Martyniuk. Economic security as a basis for cross-border cooperation of Poland and Ukraine // Security in transborder regional cooperation: Ukraine vs Poland. Edited by Olena Kovalchuk/ Lublin, 2020. P.89-101.

Weise D. Principle of Minimax and Rise Phyllotaxis. URL: http://www.mi.sanu.ac.rs/vismath/dima/index.html. (date of application: 14.10.2020).

Y. Samusevych, S. Lyeonov, A. Artyukhov, V. Martyniuk, I. Tenytska, J. Wyrwisz, K. Wojciechowska. Optimal Design of

Transport Tax on the Way to National Security: Balancing Environmental Footprint, Energy Efficiency and Economic Growth // Sustainability. 2023. Volume 15. Issue 1.

Yegorova-Gudkova T. I. Some methodological aspects of the design of sustainable economic systems: the Golden Ratio Law. Zb. scientific Pivnichno-Skhidnogo National University named after. Volodymyr Dahl. Series: Management. Lugansk, 2014. VIP. 26(1). 2014. pp. 169 - 184.

Yegorova-Gudkova T.I. The system of economic security of the state in the minds of changes: transdisciplinarity, self-organization, nature-like approach: monograph. Odessa: KP "Odeska Miska Printing House". 2021. 353 p.

Yegorova-Gudkova Tatyana. Projecting of steady complexity economic systems on self-organizing principles as a component of anti-crisis strategy. (Absract of 2012 International Conferenceon Trends and Cycles in Global Dynamics and Perspectives of World Development October 13–15, 2012), Chengdu, China, P.40 -41.