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ВЕКТОРНІ І СТРУКТУРНІ ЗМІНИ СУЧАСНОГО СВІТУ

Анотація. Розглянуто векторні і структурні зміни сучасного світу, що відбуваються під впливом екзогенних та ендогенних чинників та ідентифікуються на основі визначення статусу країн з урахуванням процесів змінюваності їхніх позицій відповідно до групової належності (країни гегемони, країни-претенденти, країни «третього світу», а також інші держави, які тяжіють до країн світового авангарду або ар'єргарду). Запропоновано методологію дослідження глобального статусу країн, основою якої є комплексний підхід до аналізу соціоприродних систем, що представлені в поєднанні економічної, політичної, інноваційної, соціальної та духовної сфер, а також сфери функціонування інститутів і сфери взаємодії людини з природою. Для з'ясування векторних і структурних змін, що відбуваються в глобалізованому суспільстві, використано метод k -середніх та апарат нечіткої логіки. Аналіз побудовано на обробці даних країн за такими показниками: Index of Globalization KOF, Legatum Prosperity Index, Global competitiveness Index, Global Innovation Index, Human Development Index, Fragile States Index, Environmental Performance Index (2009—2018 pp.). Їх обрано як атрибути, набір яких дозволяє виокремити кластери. Здійснено кластеризацію країн за складовими соціоприродних систем. За Індексом глобального статусу країн зроблено оцінку місця, яке належить суб'єктам міжнародних відносин, — ідентифіковано їхній статус. На цій основі констатовано відмінності в розвитку країн. Об'єктивовано істотну розбіжність позиціонування держав у глобалізованому світі. Виявлено умови формування глобального статусу країн і причини статусної динаміки. Доведено факт прогресування асиметрії, поляризації і нерівності. Продемонстровано, що дослідження векторних і структурних змін, які відбуваються у світовій економічній системі та глобалізованому суспільстві, розширює наукове уявлення про те, що в наш час

формується системна суперечність постіндустріальної та посткапіталістичної епохи глобалізованого світу.

Ключові слова: світова економіка, глобалізоване суспільство, векторні зміни, структурні зміни, поляризація, асиметрія, глобальний статус країн.

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VECTOR AND STRUCTURAL CHANGES IN THE MODERN WORLD

Abstract. The article examines the vector and structural changes in the modern world, caused by exogenous and endogenous factors and identified on the basis of determining the countries status taking into account the processes of changing their positions according to the group affiliation (hegemonic countries, applicant countries, «third world» countries, as well as other countries which gravitate to the world vanguard or rearguard ones). The proposed methodology of research into the countries global status is based on a comprehensive approach to the analysis of socio-natural systems, presented as a combination of economic, political, innovative, social and spiritual spheres, as well as the sphere of functioning of institutions and the sphere of human interaction with nature. The k-means clustering and the fuzzy logic apparatus were used to find out the vector and structural changes taking place in a globalized society. The analysis is based on processing the country data by the following indicators: the KOF Globalization Index, the Legatum Prosperity Index, the Global Competitiveness Index, the Global Innovation Index, the Human Development Index, the Fragile States Index, and the Environmental Performance Index (2009—2018). They were selected as the attributes, the set of which allows to distinguish clusters. The countries were clustered according to

the components of their socio-natural systems. According to the Index of Global Status of Countries, the place that belongs to the subjects of international relations was estimated and their status was identified. On this basis, the differences in the development of the countries were detected. Significant differences in the positioning of states in the globalized world were objectified. The conditions of the formation of countries global status and the causes of the status dynamics were revealed. The fact of asymmetry, polarization and inequality progression was proved. It was demonstrated that the study of vector and structural changes occurring in the world economic system and globalized society extends the scientific notion about the present day systemic contradiction of the post-industrial and post-capitalist eras of the globalized world being formed.

Keywords: world economy, globalized society, vector changes, structural changes, polarization, asymmetry, global status of countries.

JEL Classification B41, F62—64, 68

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Introduction. The modern historical period of life of society, must undoubtedly be considered as a turning point. In its depth, a new systemic quality of post-industrial, post-capitalist and simultaneously global type is gradually forming. Accordingly, the principal changes relate to the technological paradigm (the sign of the post-industrial change in society), the method of production (the sign of the emerging post-capitalism) as well as the public relations that are transformed towards universalism (the sign of globality, beyond which the economy cannot be post-industrial / post-capitalist).

At the same time, the system of public institutions is undergoing a significant transformation on a global scale. Changes occur in all their complex totality, which is inherent in a system mediating relations in all spheres of life of the modern planetary society — economy, politics, culture, etc. Society, on the one hand, is actively being imposed a universal order format through the vertical of the global power; however, on the other hand, the systemic heterogeneity of the world economy and society, significantly complicates central government. Nowadays, the manifestation of the hegemony cycles — the cycles of the global politics, which reflect the evolution of the political system and, as confirmed by world practice, are connected with long economic K-waves, is especially significant for the world-historical perspective of the mankind. The manifestation of the processes of institutionalization of power relations is that the countries with rapidly growing economies are trying to satisfy their interest in hegemony. The relationship between them and the economically developed countries clearly shows the struggle for gaining the status of the centers of a new world order / preserving the status of the core of the world economic system.

Research analysis and problem statement. Landmark events that are taking place today are of great research interest. To date, the social sciences have developed many conceptual approaches to interpreting the essence of the transformation processes and structural changes that are taking place in the global economic system and globalized society. First of all, it is necessary to mention the studies related to the fields of geo-economics and geopolitics, as well as the configuration of forces in the international arena (studies of the spheres of interaction between the subjects of the international relations). Extremely important research directions are scientific exploration of the changes in the modern world configuration, discovery of global megatrends, identification of the factors limiting economic growth, proving the facts of the crisis vulnerability of the global development, determining the nature of the contradictions of the newest global economic paradigm, caused by the universality of technologization, informatization and digitalization processes. Equally important for the study of the vector and structural changes in the modern world are aspects of the social, cultural, spiritual life of society and its interaction with nature.

This range of issues is actively being discussed nowadays by the scientific community. In this regard, it is necessary to mention publications of such scholars as: D. Acemoglu, J. Robinson [1], J. Ikenberry [2], T. Blommaert, S. Van den Broek [3], A. Benoist [4], I. Wallerstein [5],

D. Lukianenko, A. Poruchnik, V. Kolesov [6], H. Kissinger [7], E. Madison [8], J. Naisbitt [9], N. Reznikova, O. Ivashchenko [10] and others.

Society's interest in its future has never lost its relevance. However, it has become especially great nowadays, since the changes in the systemic redistribution on the global scale have shown up in the society more clearly than ever before. In response to the request of the society for options of the further destiny of mankind in the era of the formation and development of post-industrial and post-capitalist relations, fundamental science in the study of economics, politics, and society as a whole offers many scenarios. Their diversity is determined by the continuous changes occurring in all spheres of life of the society. In turn, the changes in the level of subsystems (economy, politics, social and spiritual spheres, the sphere of functioning of institutions, and human interaction with nature) are influenced by numerous factors of multidimensional action. In this context, the analysis of vector changes and deep structural transformations of a globalized society becomes an extremely important area of scientific research.

The purpose of the article is to analyze the vector and structural changes in the modern world which occur under the influence of exogenous and endogenous factors and are identified on the basis of determining the countries status, taking into account the processes of variability of their positions according to their group affiliation (hegemonic countries, applicant countries, «third world» countries, as well as other countries that gravitate towards the world vanguard or rearguard ones).

Research results. The global status of a country is an aggregate set of features, which determine the state's place in the international relations system at the current stage of contemporary history. First of all, it is about the changes that globalized society is undergoing today; about the configuration of the modern world formed by the states, the balance of their power in the world arena, the consequences of the struggle for world leadership, the networking and coalitionality of the multipolar world. However, it is worth noting that the status acquired by countries has had significance in all times of human history, while remaining quite a movable phenomenon. World history knows many examples of the emergence and ending of empires, the rise and fall of states, the changing economic and political role played by different countries at different times. Nowadays, the time of accelerated development and singularity [3], the reasons for such transformations occur more frequently, and transformation processes in the system of international relations develop more rapidly. In other words, there is now an active status dynamics of the countries — the process of changing the places they occupy in the system of globalized relations.

Consideration of the issue of the countries status implies taking into account the diversity of aspects against which the strengths and weaknesses of states parties to international relations are assessed. Among the spheres of public life, the economic, political and social spheres have traditionally been analyzed first. Their development, as well as the modern life of society as a whole, is substantially driven by advances in technology. Different technological levels of the countries development lead to significant economic differences between states, result in different social status of their peoples, causes differences in the competitive capabilities of their macroeconomic systems, and indirectly contributes to the stability and power of political ones. It should also be noted that state institutions are an important mechanism for creation, distribution and use of wealth in society. The effectiveness of their action have an essential impact on ensuring the adequacy of the countries development for today's post-industrial and post-capitalist-oriented relations, which are being established in the globalized world.

Outlining the intrasocial structure, the content of which should form the basis of determining the global status of countries, it is necessary to note the special importance of the spiritual sphere in our time. Given that the contemporary specificity of relations is determined by the priority of human development (the value of their knowledge, creativity, spirituality), the intellectual and spiritual development of nations becomes a necessary motivating prerequisite for qualitative systemic transformations. It is the imperative of the conscious and spiritual behavior that ultimately determines the real progress of the socio-economic system, following the model of which a particular country develops.

In addition, a measure of conformity to a particular (either value-humanistic or pragmatically-rational) way of life of the members of society determines the conditions of human interaction with nature. The point is that in determining the global status of countries, analysis should not be limited to an assessment of their intrasocial structure. It is necessary to consider the possibilities and prospects of the progress of national socio-natural systems (as well as the threats to their development and the likelihood of stagnation or regression). Socio-natural systems (according to their names) are the formation of two interacting components — society as a social community and nature; a combination of economic, political, social, and spiritual spheres, on the one hand, and the sphere of human interaction with nature, on the other.

By participating in the formation of systemic integrity, each component of the socio-natural complex in its defining spheres is inversely dependent on the overall quality of the system; on the synergistic effect accumulated within it. At the same time, the functioning and development opportunities of each of the socio-natural systems depend on the country's involvement in the global system of relations. Thus, the state and dynamics of each sphere in each country is dependent on the effect of the joint influence of many factors of internal and external origin, multiplied by their cross-interaction [19].

The overall quality of the socio-natural system (the factor of the reverse aggregate influx of factors of internal origin on the state and dynamics of each of its constituents) is, in fact, a reflection of the wealth accumulated and used for the benefit of the development of society. It is a deep understanding of national wealth that exists in the diversity of its forms (material, value, in the forms of human, intellectual, and social capital, institutions, as a public good, etc.). In the context of analytics, the Legatum Prosperity Index (LPI), developed by the Legatum Institute think-tank (London), is the most relevant to understanding the status of countries in today's globalized world. It reflects wealth and social well-being, taking into account the performance of such areas as economics, entrepreneurship, governance, education, health care, security, personal freedom, and social capital.

The assessment of the degree of the country involvement in the globalization processes (the aggregate influx of factors of the external origin on the state and dynamics of the components of the socio-natural system) is clearly reflected by the KOF Globalization Index, developed by the KOF Swiss Economic Institute. The advantage of its use in the practice of analyzing the global status of countries is that the index reflects the situation by three integration «pools» — economic, political and social ones [18]. These two indicators (LPI and KOF) are able to provide the conditions necessary for analyzing the action of a set of endogenous and exogenous factors, under the influence of which the components of socio-natural systems change qualitatively. The interaction of such components (now at a new level of qualitative systemic changes) will eventually determine the global status of countries.

Determining the place (the global status) of the countries in the system of international relations is preceded by the isolation of the groups of target countries. Clustering is carried out sequentially: by the state of economic development, by the state of technological development, by the state of the development of social, spiritual and cultural spheres, by the effectiveness of foreign policy and state regulation and by the efficiency of environmental management. Estimate indicators are the Global Competitiveness Index (GCI), the Global Innovation Index (GII), the Human Development Index (HDI), the Fragile States Index (FSI), and the Environmental Performance Index (EPI) respectively (*Fig. 1*).

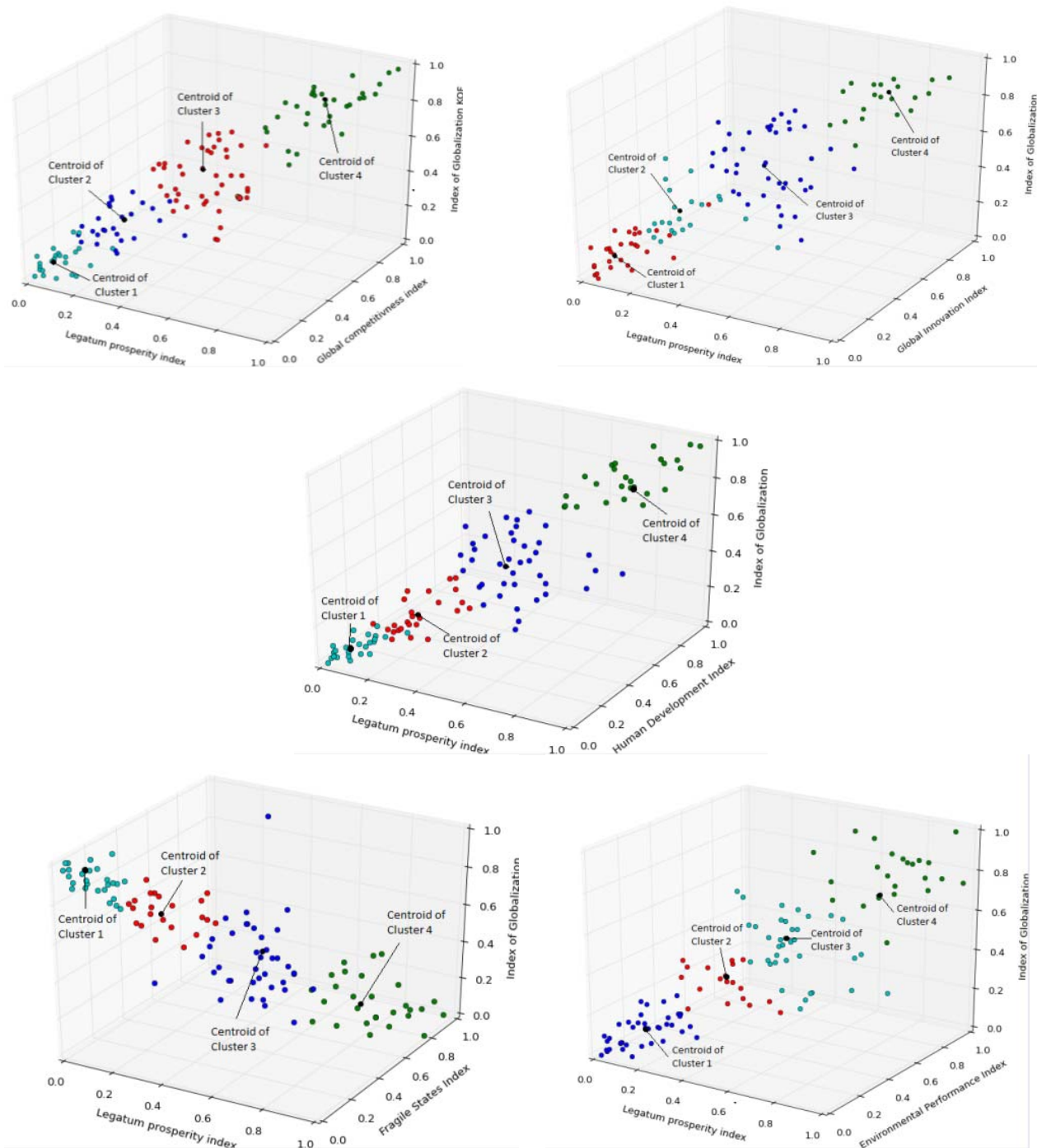


Fig. 1. Clustering of Countries by Attribute Traits, 2009—2018

Created by the authors based on data from the Yale Center for Environmental Law and Policy; The Fund for Peace; Cornell University, INSEAD, WIPO; United Nations; KOF Swiss Economic Institute; WEF; Legatum Institute; for 2018 respectively: [11—17].

The indicators listed are the attributes (i), the set of which (I) allows to isolate clusters (c) and their set by groups (C). In a formalized form, the sequence of actions is described as follows:

$$I, I = \{i_1, i_2, \dots, i_n\}; F : I \rightarrow C; C = \{c_1, c_2, \dots, c_m\}. \quad (1)$$

Python programming language was used for clustering. Twenty clusters of 4 groups of similar objects were obtained for each of the constituent socio-natural systems, which provide a picture of the countries positioning by individually taken parameters. The parameters of the models according to the characteristics of the economic, technological, social, spiritual and cultural development, as well as the effectiveness of foreign policy and state regulation and the efficiency of environmental

management are described as follows: KOF — LPI — GCI, KOF — LPI — GII, KOF — LPI — HDI, KOF — LPI — FSI, KOF — LPI — ERI. That allowed us to identify the countries that are typical representatives of each of the clusters (*Table 1*).

Table 1

Representation of Countries Close to Centroid Clusters Formed on the Basis of Components of Socio-Natural Systems, 2018

Features of clustering models (components of socio-natural systems)	Clustering Models Parameters	Number of countries taken for analysis	Clusters			
			1	2	3	4
state of economic development	KOF — LPI — GCI	128	Denmark Austria Germany	Philippines Dominican Republic Saudi Arabia	Cameroon Malawi Yemen	Bangladesh Nepal Guinea
state of technological development	KOF — LPI — GII	116	Canada Australia Germany	United Arab Emirates Latvia Qatar	Brazil Sri Lanka South Africa	Zimbabwe Uganda Nigeria
state of development of social, spiritual and cultural spheres	KOF — LPI — HDI	118	United Kingdom Canada Germany	Poland Italy United Arab Emirates	South Africa Ecuador Georgia	Liberia Uganda Nigeria
effectiveness of foreign policy and government regulation	KOF — LPI — FSI	119	Canada Germany Austria	United Arab Emirates Latvia Panama	Sri Lanka South Africa Ecuador	Venezuela Uganda Nigeria
efficiency of environmental management	KOF — LPI — EPI	118	Australia Germany United States	Argentina Jamaica Macedonia	Botswana Ghana Saudi Arabia	Uganda Côte d'Ivoire Nigeria

Source: Compiled by the authors.

The cluster centroid (k_j) is determined by the k-means method. Each iteration is carried out in two steps: 1) updating the clusters formed by a certain attribute trait (by determining the shortest distance between the objects), resulting in their gravitation to the closest of the country groups, and 2) updating the centroids (through sequential repetition of actions leading to the center of gravity of the cluster). K-means centroid updating ensures that typical representatives get into high density areas (countries).

Clustering of countries by the components of socio-natural systems is the basis for determining the Index of Global Status of Countries (IGSC). The results obtained form a set of input variables, which the fuzzy logic apparatus transforms into an output variable — the Index of Global Status of Countries (IGSC). Mamdani algorithm was used to construct fuzzy inference; data processing is done with the Matlab application package. The output variable ($T = \{T_j\}$ is a term-set of IGSC values) eventually acquires three values: T_1 — low, T_2 — medium, T_3 — high. That means that countries belonging to clusters 1 and 2 have a high status in the globalized world, countries in cluster 3 have a medium status, and countries in cluster 4 have a low status. The applied methodological approach to the analysis of the global status of countries and the logically ordered methodology allow to make comparisons between countries and to evaluate changes that have taken place in recent years.

Comparison of data by clusters makes it possible to establish a boundary that divides the world into two parts. The first part includes the most developed countries and countries that by their development move to the core of the world system (countries of the first and second clusters); the second one comprises the rest of the world (countries of the third and fourth clusters). This group positioning of countries reflects the global status index, which in the countries belonging to clusters 3 and 4 is several times lower than that of the clusters 1 and 2. Thus, the polarization of the world is obvious. Moreover, the gap between countries is widening and this growth is extremely intense. Comparison of the averages at two time intervals (2009—2016 and 2009—2018) indicates that in the first one, the lag of the countries of the lower clusters from the countries of the higher clusters was in the range close to the value of 2—4 times whereas only two years later, this gap widened to 2.5—4.5 times (*Table 2*).

Table 2

The Index of Global Status of Countries (IGSC) by Clusters, 2009—2018

Cluster	The centroid value of IGSC	The size of the lag of the IGSC of the lower clusters from the IGSC of the higher ones		The lag rate of IGSC of the lower clusters from the IGSC of the higher ones, %	
		chain-linking method	fixed base method	chain-linking method	fixed base method
2009—2018					
1	0.144	×	×	×	×
2	0.163	-0.019	-0.019	-13.19	-13.19
3	0.500	-0.337	-0.356	-206.74	-247.22
4	0,789	-0.289	-0.645	-57.78	-447.92
2009—2016					
1	0.159	×	×	×	×
2	0.178	-0.019	-0.019	-11.95	-11.95
3	0.500	-0.322	-0.341	-180.90	-214.47
4	0.790	-0.290	-0.631	-58.00	-396.86

Note. The centroid value of IGSC cluster 1 is taken as 100 %.

Source: Calculated by the authors.

Analysis of the results of clustering by the components of socio-natural systems explains the reasons for changes in global positioning of countries. The value of a place that might potentially belong to the country ranges from 0 to 1. Therefore, an increase in this value for the country, which is a typical representative of the group, indicates that there are more countries in the cluster with lower places in the rating (Table 3).

Table 3

Results of the Countries Clustering by Components of Socio-Natural Systems, 2009—2018

Clusters	The centroid value	KOF — LPI — GCI	KOF — LPI — GI	KOF — LPI — HDI	KOF — LPI — FSI	KOF — LPI — EPI
1	2009—2016	0.13	0.23	0.10	0.92	0.11
	2009—2018	0.15	0.12	0.07	0.92	0.11
	gain / loss	+0.02	-0.11	-0.03	—	—
2	2009—2016	0.34	0.48	0.31	0.68	0.33
	2009—2018	0.41	0.35	0.25	0.75	0.36
	gain / loss	+0.07	-0.13	-0.06	+0.07	+0.03
3	2009—2016	0.53	0.56	0.53	0.39	0.55
	2009—2018	0.63	0.58	0.50	0.48	0.56
	gain / loss	+0.10	+0.02	-0.03	+0.09	+0.01
4	2009—2016	0.82	0.83	0.81	0.24	0.89
	2009—2018	0.87	0.88	0.88	0.17	0.83
	gain / loss	+0.05	+0.05	+0.07	-0.07	-0.06

Note. In the ranking of fragile states, the most dangerous countries rank first; the last ones are the most institutionally stable; accordingly FSI is the reverse indicator.

Source. Calculated by the authors.

The first group has become even more elitist (2009—2018) than before (2009—2016). The representation of the countries in this group has expanded by only one indicator (in terms of global competitiveness); in two positions (innovation and human development) the representation of the countries has decreased; for the other two positions (institutional sustainability and environmental efficiency) it has not changed. In fact, there was an outflow of countries from the higher clusters to the lower ones. In the second group, the representation of the countries expanded by two positions and decreased by three (cf. the Fragile States Index is reverse); in the third group, it expanded by three and decreased by two positions; in the fourth group, it expanded by four and decreased by one position.

The configuration of the areas generated by the cluster's gravity deserves special consideration. The middle clusters are unequally vector oriented: the second cluster — towards the first one and the third cluster — towards the fourth one. According to the IGSC (2009—2018), the gap between cluster 1 and 2 countries is about 13%, and between cluster 3 and 4 countries — 58 % (for comparison: the lag of the third cluster countries from the second one in this indicator is more than twice, and compared with the first deviation — almost 2.5 times).

Conclusions. The changes taking place in the globalized society need to be evaluated simultaneously in the aspect of the development of all the defining spheres of human activity (economy, politics, social and spiritual spheres, the sphere of functioning of institutions, and the sphere of human interaction with nature), which in their totality and interdependence form the countries socio-natural systems. The quality of the development of socio-natural systems is a decisive prerequisite for the place that the country will occupy in the system of modern international relations.

The results of the study, based on the determination of the global status of the countries, revealed a significant difference in the development and positioning of states in the globalized world. The use of the countries clustering by components of socio-natural systems and determination of clusters according to the Index of Global Status of Countries (2009—2018) made it possible to identify the vector and structural changes taking place in the globalized society and are phenomenal for the present. On this basis, the fact of the progression of asymmetry, polarization and inequality is confirmed, which ultimately forms the systemic contradiction of the post-industrial and post-capitalist eras of the globalized world.

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