

Sustainable Development and the New Architecture of the Global System: the Principle of Self-Organization

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Abstract

The process of change in the world economy during the last 200 years shows that there is a certain 70-year regularity in its development, which is expressed in increased structural complexity of the global economic system every 70 years. The evolution occurs after certain periods of bifurcation (up to 50 years) accompanied by lower rates of economic development, and periods of adjustment (up to 20 years) with the higher rates. The theoretical justification of this process shows that the increased structural complexity of the global economic system represents the external manifestation of a self-organization process in the larger system we call the “world economy”.

This process of development is based on two fundamental laws of nature, namely: the principle of minimum dissipation of resources and the law of conservation of accumulated economic efficiency; and it is realized via two types of development mechanisms – bifurcation and adjustment.

In order for the sustainable development to become the basis of the world security system, the process should rest on applying the natural laws of development, and it should lead towards the creation of a complex, two-leveled (regional and global) structure by establishing the geopolitical pluralism, based on the “principle of minimum dissipation”. This will contribute to the development of the global system on a conflict-free base.

Key words: *sustainable development, global economic system, cycle, self-organization*

Introduction

The aim of this paper is to reveal and define phenomena, which are characteristic for the behavior of complex systems in the process of their development on the basis of factual material of the world economy development during the period of 1825-2000. Some elements of the work were presented at scientific forums taking place in the USA, Spain, Italy, and Russia. Theoretical issues are explained in the monography “Self-Organization of the World Economy. Euro-Asian Context”.

The social system – “the world economy” – is considered a complex system consisting of two global subsystems: economic and political. The common agents of both subsystems are the national economies, which interact in economic and political spheres and form connections and structure of the social system of the world economy. We could use here the term “world system” (or global system), which could include both economic and political subsystems. But we believe that the term “social system – world economy” is more suitable because we assume that the political system being an object of non-economic scientific disciplines should be included into economic scientific domain. Such an approach allows us to view the political

system as an object of economics thinking that a certain type of political system has an influence on the economic results of the world socium. Thus, hereinafter the term “world economy” will mean complex, combined social system. We understand the economic system of the world as an aggregate of the subjects of the world economy – national economies and their economic relations appeared in the process of international exchange of resources on the basis of international division of labour. The economic system called “world economy” can be structurally expressed by a system of international economic relations: the geographical and productive structure of the international trade; the geographical and social structure of the international migration of labour resources; the international flow of capital.

Functionality of international economic relations is achieved on the basis of created international monetary system. The political system of the world economy is an aggregate of direct and indirect (i.e. through accepted collective decisions in super-national institutes) diplomatic relations between countries taking part in international division of labour providing legitimacy of functionality of international economic relations.

Functionality of the social system “world economy” means establishing economic and political relations in the process of international exchange of resources on the basis of international division of labour with the aim of ensuring the most effective distribution for production under circumstances of scarce resources and distribution of manufactured products under circumstances of unlimited growth of consumption. The main functional purpose of the social system “world economy” is the introduction of self regulation among the agents of economic system through the political system (because national economies are the common agent for both economic and political systems) which results in a state of maximum dynamic equilibrium of the economic system “world economy” – the state of economic growth of the world economy.

Today it is well known that the main problems of the world economy are: threat of ecological cataclysms, poverty and destitution of two thirds of the world population, mass hunger, illiteracy, etc., under circumstances of continuous growth of the population on this planet and limited world resources. Therefore, availability of a mechanism to allow an effective redistribution of valuable resources in the scale of developing global economy is a vital necessity to solve global problems.

Development of social system means a process of increasing its stability under the influence of outside environment (keeping stability in the given limits – homeostasis) by means of accumulation of structural information changing the quantity of organization (effectiveness) of the system and making its structure more complicated. Increasing of stability is expressed in accumulation of economic effectiveness and formation of more complicated structure of society.

Development of world economy means a co-evolution of economic and political subsystems development resulted in further gradual complication of social structure, which strengthens the system’s stability under the influence of environment, pressure of population growth and limited resources.

Development means a change of equilibrium states with different macro-economic characteristics. Each state is expressed in structural and quantitative characteristics. For world economy we will consider the international monetary system (IMS) as a structural characteristic. We will consider the growth rate of the gross national product of countries participating in international economic relations as a quantitative characteristic.

Our task is to formulate verbal model of development and self-organization of the world economy as a social system and having basic concepts of the theory of social development [1], to determine and formulate systemic regularities, which are the basis for the world economy development and, consequently, for the new structure and organization of the world economy. As a result, on the basis of concluded regularities, it will be possible to estimate a forecasting variant of the state of the world economy in the nearest future.

Idea and Description of the Model of the World Economy Development

To explain the process of self-organization of social system “the world economy” properly and to demonstrate interconnection between the processes of self-organization, interaction of political and economic subsystems and evolutionary development of social system, we decided to use speculative space-and-time, three-dimensional model of self-organization on the basis of the R. F. Abdeev’s model through introduction of structural and quantitative characteristics – criteria, which define different states of the system “the world economy” (hereinafter “the world economy system”) in the process of its development. The idea of the model is based on the simple assumption “...that the phenomenon of development as a whole can be considered as a struggle between two opposite tendencies – organization and disorganization. The process of development beginning with maximum disorganization can be described as a process of accumulation of structural information, which is calculated as the difference between the real and maximum values of entropy. Therefore, phenomena of development are advisable to consider in coordination with conceptions of entropy (information) and with possibility to measure the level of organization (or disorganization) of the system at each stage of its development. Thus, the speculative model receives its polar-potential system of coordinates, speculative three-dimensional space in which disorganization, while being introduced more and more, is diminishing from periphery towards center (towards axis of the model) which simultaneously means increase of level of organization of the given object as it is developed...” [2]. The model of self-organization of the world economy system is represented in the form of vertical convergent spiral around the axis reflecting economic effectiveness as quantitative expression of its development. The spiral itself is, in essence, a trajectory of development of the world economy throughout time. Loops of development reflect repeated cycles of development but at the qualitatively higher organizational level. Projection of loops on the plane and radius of remoteness from the axis of effectiveness demonstrate the quantity of organization in the world economy system for every observed state. Gradual decreases of radius from loop to loop shows the process of decreasing the quantity of disorganization (entropy) and increasing the quantity of organization of economic system. All this demonstrates the essence and dynamics of the process of development.

Structural and Quantitative Characteristics of the States of the World System

Development of the world economy as a big complex system represents the change of its states. Each state has structural and quantitative characteristics. Thus, for adequate description and simulation of the process of development of the world economy system, we will need to distinguish its states in the process of development and to define structural and quantitative characteristics for each distinguished state. Taking into consideration the above mentioned fact, most of researchers of the world economy development consider relations between countries of Western Europe, USA, Canada and Japan, as a core of development of international economic relations for the period of the time 1825-2000. For the observed interval of time international economic relations are based on the international trade, migration of population and flow of capital between Western Europe, USA, Canada and Japan. The skeleton foundation for all above-mentioned elements of international economic relations is the international monetary system, which provides implementation of all such relations. *Therefore, we consider the structure of international monetary system as a structural characteristic of organization of international economic relations and, consequently, of the world economy system.* As it is known, international monetary system possesses the following structural characteristics: type of universal money; type of world reserves; type of currency exchange (system of exchange rates); availability or absence of super-national institutes regulating international monetary relations.

Important changes in at least one of these characteristics lead to change in the international monetary system as a whole and, consequently, to the change of organization of the world economy system, i.e. changes of system's state in the process of development. In order to aggregate these characteristics, three types of systems classify the international monetary system: gold standard, Bretton-Woods system and Jamaica system, which define three states of the world economy system. The period of time when the main structural elements of the international monetary system are created and preserved is a period of existence of one state of the world economy system in the process of its development. One state corresponds to one single cycle of development. One cycle of development of the world economy system includes two different periods which are defined according to the type of mechanism of development and to the model description in terms of quantitative characteristics: a period which is characterized by a bifurcation mechanism of development; a period which is characterized by an adaptation mechanism of development. Accordingly, each type of international monetary system passes through two stages of its development and functionality. The system is formed at the stage of bifurcation. At the stage of adaptation the system is actively functioning. Different rates of the world economy growth are connected with these periods: in the period of action of bifurcation mechanism of development you can observe decrease in the rate of economic growth of the world economy; in the period of adaptation you can observe spasmodic increase in the rate of economic growth of the world economy. *A synergetic effect is realized.* To simplify calculations of quantitative parameters introduced into the model, we also take this prerequisite into consideration. *So, we calculate the quantitative characteristic of the states of the world economy system for the interval of time 1875-2000 as an average value of growth rate of gross national product for above mentioned countries for each observed period of time (in %). For the period till 1875 the rate of the world economy growth is assumed as 1.5%.*

Development and Self-Organization of the World Economy System

According to stated criteria, the analyzed historical period of development of the world economy system is from 1825 of the 19th century till 2035 of the 21st century. On the basis of temporal intervals of action of indicated systems of international monetary relations and quantitative characteristics, we create temporal boundaries of existence of three states of the world economy system in the process of its development. Thus, we define temporal intervals of three cycles and six periods of development of the world economy system.

They have the following structure:

The first state. The first cycle of development of the world economy system is a period of functionality of the gold standard system: 1825-1875-1895.

The first period of the first cycle of development: span of time is 1825-1875; transformation period; formation of the gold standard system; action of bifurcation mechanism of development; rates of growth of the world economy – 1.5%.

The second period of the first cycle of development: span of time is 1875-1895; active functionality of the gold standard system; action of adaptation mechanism of development; rates of growth of the world economy – 2.6%. In the sphere of policy: participant countries in international economic relations came to mutual collective agreement on bilateral basis about exchanging their currencies for gold; principle of achievement of social, collective agreement in international economic relations in the sphere of monetary relation was implemented. So the world political system was being created mainly on the basis of direct diplomatic relations and in the form of military unions, coalitions, etc.

The second state. The second cycle of development of the “world economy” system – period of functionality of the Bretton Woods system – 1895-1945-1965.

The third period of the second cycle of development: span of time is 1895-1945; transformation period of Bretton-Woods system foundation; action of bifurcation mechanism of development; rates of growth of the world economy – 1.8%;

The main result of the third period of the second cycle of the world economy development became a super-national institute including systems regulating international financial and trade relations, realizing the principle of social, collective agreement of participant countries in the process of formation and implementation of international economic relations. Such relations assumed mutual regulation of currency rate, crediting of payment balances of countries-participants, decrease of tariff limits in international trade, etc.

The fourth period of the second cycle of development: span of time is 1945-1965.

In the sphere of economy: During this period, rates of the world economy development were high and spasmodically increased up to 5-6%, when compared with analogue indicators of the previous period. The mechanism of development was one of adaptation. Till the end of the 60s and the beginning of the 70s (1972 – 1973) the system of international economic relations reached their maximum effectiveness for the current state and started transforming into the next stage. The change of principles of the monetary relations defined by Jamaica Conference became the logical conclusion of the fourth stage of development of the world economy system. Conditions for international monetary relations had not been established completely. Jamaica conference just initiated such changes. In the sphere of policy: regional and global super-national institute started their formation. They received further development in the next fifth period of the third cycle of development. As a whole, bipolar political system and ideological opposition kept global political and economic stability. The world political system received an instrument of solving conflict situation by mutual agreement – UN, which included not only institutes of regulation of world economy but Security Council as well – institute of regulation of military and conflict situation.

The third state. The third cycle of development of the world economy system – period of Jamaica system – 1965-2015-2035.

The fifth period of the third cycle of development – period of transformation of international monetary relations and formation of its new structure; span of time 1965- 2015; action of bifurcation mechanism of development; rates of growth of the world economy system – 3.4%.

That period defined two phenomena of global development. One of them was the phenomenon of regionalization: by the 90s of the 20th century 23 international organizations of integrated type with regional location had been created (EU, NAFTA, MERCOCUR, ASEAN etc.). They possessed more than 60% of the world gross domestic product and the major share of the volume of international trade – about 8 trillion dollars. Besides, 85 regional trading and economic agreements were concluded in 90s. The second phenomenon was globalization. Thousands transnational corporations in the world possessed up to 50% of the world production and up to 63% of the foreign trade. Such capital and resources flows were not supervised by the State. And it should be noticed that we are speaking about effectively distributed resources. *This allows to state that the national State as a form of organization of people activity connected with distribution of resources and benefits within limited territory and limited quantity of people became less effective when compared with regional variant of creation of groups of countries and global resources flows.*

Political situation in the world dictates two ways out. The first one – creation of new political order of the world on the multipolar and two-level base: regional and global. (It's due to new leaders with significant economic and military potential that appeared on the world scene. These are EU, China, India, and Japan). The second way out – the structure of political system of the world should foresee the implementation of principles of group agreement between developed, developing and underdeveloped countries.

The sixth period of the third cycle of development – forecasting, period of active functionality of new system of international monetary relations; span of time 2015-2035 (forecast); action of adaptation mechanism of development; rates of growth of the world economy – 8-9% (forecast).

According to stated structural and quantitative characteristics of organization of the system of the world economy, we distinguish three states. Each state corresponds to one of three types of system of international monetary relations and three cycles of development, which correspond to six periods of development of the world economy system, five of which are real and the sixth is theoretical or forecasted.

On the basis of distinguished states of the system we build a model of self-organization and development of the world economy. (Figure 1)

Conclusions

1. Each consequent distinguished state of world economy has a more complicated organization of the political system and international monetary system. And this fact demonstrates the tendency of complication of world community structure.
2. Each consequent state is more effective from economic point of view and has a higher rate of economic growth. This allows world economy to develop steadily in conditions of grown population of the planet and limited resources. A tendency of growth of the economic effectiveness of the whole system is observed in the long-lasting interval of time.
3. The process of consequent structures foundation of both political and economic organization of the world economy took place under the conditions of a strongly unbalanced environment in the form of numerous military and civil conflicts and economic crises.
4. All things stated above allows us to conclude that: the system of the world economy possesses the feature of the complex systems – self-organization. The Oksanger-Prigogin's principle of minimum energy dissipation is realized in the process of development. Each consequent organization of world economy produces less entropy than the previous one. The category of energy in physical system corresponds to category of resources in social system. Thus, the principle of minimum dissipation of limited resources acts in social systems. The model reflects the realization of this phenomenon in the process of development and self-organization of the world economy. The development direction of the world economy system is defined by the law of conservation of accumulated effectiveness and this allows us to say that the model has predicted potential for realization of prognosis of future organization of the world economy.
5. The global socium security assumes the socium self-preservation under the impact of various destructive processes: increasing risk of ecological disaster, mass dissemination of the epidemic diseases that people are not able to cure yet, growing death-rate due to the ubiquitous poverty and famine, increasing deficit of finite energy resources because of their non-reproducibility (the world oil and gas reserves are available for 30-35 years of the civilization existence). According to the experts, the global warming (greenhouse effect) could happen within nearest 50 years. Besides, the threat of nuclear catastrophe and war conflicts are still unfolding in the world.

The possible ways of solving the above problems are complicated by multi-religious and multi-cultural environment, peculiarities the population mentality in the whole world and by differences in natural resources available in various regions of our planet.

Thus, provision of the worldwide security means the necessity to create institutions of the global socium, which would support the socium stability in above circumstances.

The worldwide security is undoubtedly impossible without the realization of joint interests of diverse geographical, cultural, ethnic, etc. groups of population around the world.

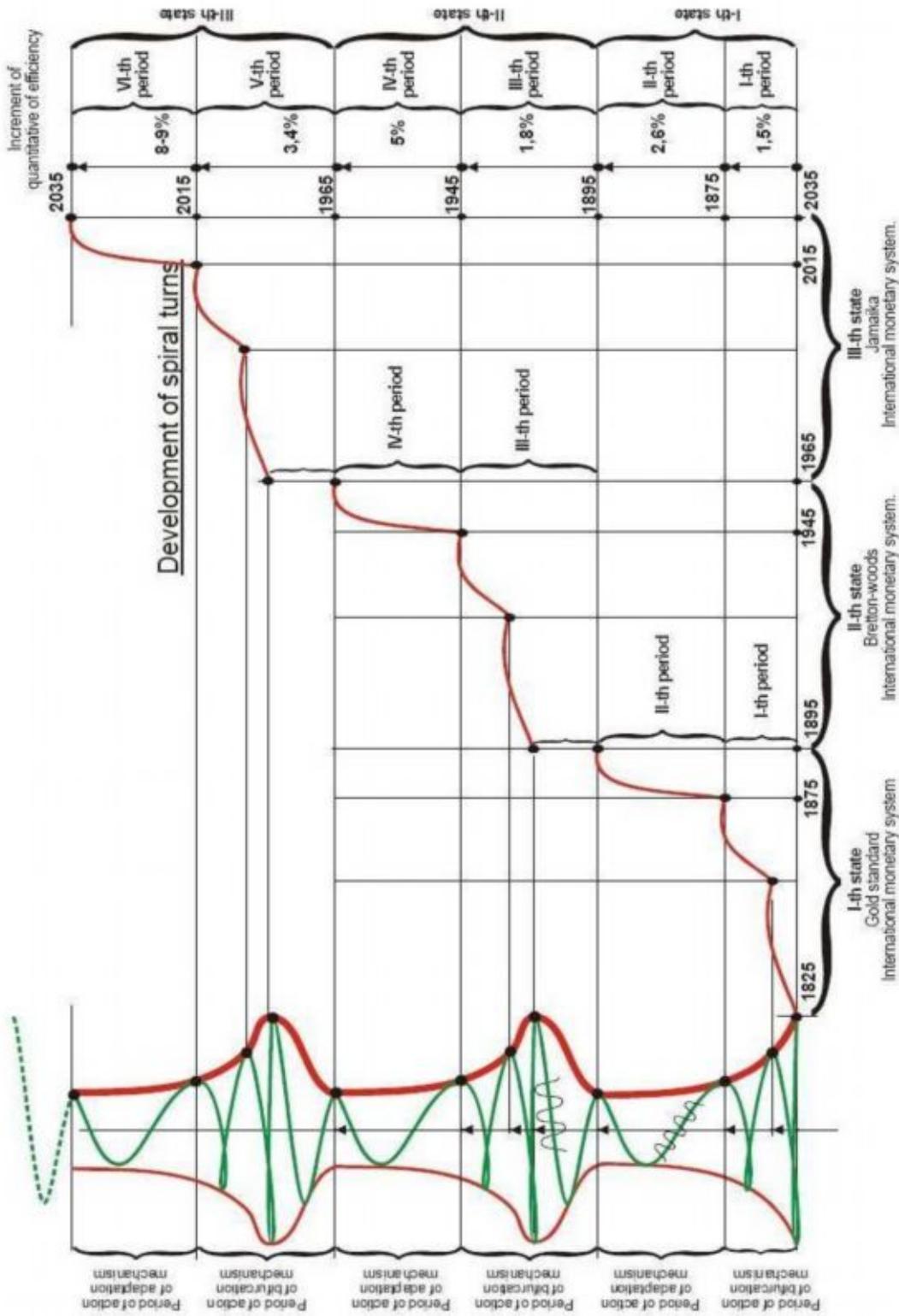


Fig. 1. The model of development and self-organization of World economy for interval of time 1825-2035

The population joint interests could be realized via establishing the institutions of geopolitical pluralism on the basis of principle of public harmony at the regional and global levels. The institution of the public harmony is a mechanism of optimization of solving the existing problems on the platform of functionality of natural laws: minimal dissipation of energy (recourses) and the law of conservation, both forming the trajectory of the civilization development. As it could be obvious from the above, such laws underlie a big and complicated system of the world economy. The worldwide security means the establishment of the institutions which can embody and support these laws of Nature.

Such institutions will provide stable and conflict-free development of the global socium in the long run.

As for the mode of real time, we could speak about reforming the Organization of the United Nations into a system allowing realization of joint regional and national interests of developed, developing, backward countries, countries with transitional economy, etc., in the context of solving the world problems. This assumes the necessity to create the institutions able to conduct the worldwide control over the rare resources (energy resources) being in terms of crisis, the process of preservation of the ecosystem.

This should be in line with all-round awareness that the planet is the same for everybody – for the USA, Iraq and for a small tribe somewhere in Africa. Within the system, an effective mechanism should be created to restrict the activity of those countries or group of countries whose military potential incite them to actions that do not take into consideration the interests of individual nations or those of the whole planet. The system should rest on the creation of All-Planetary Constitution – the Fundamental Law, which all existing forms of the people organization shall observe. Within the Fundamental Laws, the wide spectrum of problems of preservation of the global socium, starting from local conflicts and ending with preservation of the ecosystem and life on the Planet as a whole can be and must be solved.

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Dezvoltarea durabilă și noua arhitectură a sistemului global: principiul self-organizării

Fenomenul schimbărilor din cadrul economiei mondiale de-a lungul ultimilor 200 de ani arată că există o regularitate de 70 ani în evoluția sa, ceea ce se exprimă prin creșterea complexității structurale a sistemului economic global la fiecare 70 de ani. Evoluția se petrece după anumite perioade de bifurcare (până la 50 de ani), însoțite de rate mai mici ale creșterii economice, respectiv perioade de adaptare (până la 20 de ani), când ratele sunt mai ridicate.

Justificarea teoretică a acestui proces arată că amplificarea complexității structurale a sistemului economic global reprezintă manifestarea externă a unui proces de auto-organizare, în cadrul sistemului major numit „economie mondială”.

Acest proces de evoluție este bazat pe două legi fundamentale ale naturii: principiul risipei minime a resurselor, respectiv legea conservării eficienței economice acumulate și se realizează prin intermediul a două mecanisme de dezvoltare: bifurcare și adaptare.

Formarea dezvoltării durabile ca bază a sistemului securității mondiale ar trebui să se bazeze pe aplicarea legilor naturale ale dezvoltării și să conducă la crearea unei structuri complexe, cu două niveluri (regional și global) prin instituirea pluralismului geopolitic, bazat pe implementarea principiului risipei minime. Aceasta va contribui la dezvoltarea sistemului global pe o bază liberă de conflicte.