

# Theoretical and Methodological Basis of Economic Dynamics as a Reflection of the Interaction of Economic, Social and Ecological Systems

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## Abstract

An important scientific problem is the assessment of the interaction of economic, social and ecological components in the former social ecological and economic systems, the identification of patterns of their cross impact and the definition on this basis of options for projection of socioeconomic development with the preservation of the natural environment. The article analyses the improvement of modelling processes on the formation of optimal socioecological and economic systems in order to reduce the negative impact of substantive production on the human habitat. It also marks the influence of changes in some variables on the change in the others in the process of complex systems formation.

**Keywords:** economic dynamics, model, economy, environment, system, substantive production, variables, world system, global crisis.

## 1 INTRODUCTION

Economic dynamics is determined by the specificity of social development as a reflection of the processes of continuous circulation of correlated and interdependent transformation in the economic, social and natural systems, which determine, by internal and external forces, the formation, evolutionary development, crises and collapse of socioeconomic structures. The association of incessant and diverse qualitative and quantitative transformation of the elements in the socioeconomic system, the irreversibility of this process is determined by the continuous nature of evolutionary development, the consistency of the development of industries and sectors of the economy, section of public life, the optimal state of the organization of the public life in general. In this regard, one of the main problems of economic dynamics is the problem of the equipoise, proportionality and balance of the elements of social life, which ensure the sustainable socioeconomic development.

The research of the theoretical prerequisites for creating conditions for this balance encourages scientists, analysts and practitioners to create its perfect model. But taking into consideration that it is based on many economic, social, political, environmental and other factors, the dynamics and patterns of these changes, the formation of dynamic equilibrium and its multiple nature, the alternation of phases of cyclical development, as well as other significant problems of socio-economic development, this purpose is extremely difficult. The complexity of this problem is increasing due to the acceleration of the dynamics of social production and the raising importance of the two main trends. First, there is not only quantitative and qualitative exhaustion of sources of natural resources that forms the material basis of modern production, but also fauna and flora reduced in consequence of the human activity, significantly reducing the ability of environmental systems to restore, maintain their sustainable functioning and ensure favourable conditions for human development. Second, the pollution of the environment by industrial and household waste hampers the natural processes in the environment and requires the involvement of an increasing amount of resources for the active processing.

In this regard, it is important to highlight in the formation of the optimal socio-ecological and economic system such an important direction as improving the efficiency of the natural resource base on the exploitation of secondary resources. Capitalization of secondary resources contributes not only to a significant reduction of the negative impact of industrial and household waste on the environment, but also to a more harmonious combination of social, economic and environmental interests.

Close interrelation of active economic activity of the person and more accurate understanding of its dependence on a condition of the environment also induces many researchers to consider this dependence in its integrity and systematicity as union socioecological and economic system.

## 2 THEORY

Until the middle of the twentieth century the researching problem was considered under the prism of the limited natural resources in the interaction of ecology and economy, considering the significant increase in economic dynamics. In this connection, the negative effects of economic activity on the human environment from the point of view of the decline in both the quality of labour resources and the quality of life did not attract the proper attention of economic science. This is explained by the corresponding proportion of unlimited economic growth, low level of productive forces, high level of self-regulation of the biosphere, ensuring the sustainability of the ecological system [3].

The relative ability of the ecological system to self-recovery are reduced with the growth of technical weapons of the economy, the provision of significant anthropogenic impact. The transformation of the biosphere is formed based on its wider transformation into technical and man-made objects in order to better satisfaction of the socio-economic requirements [1]. Nature in a great extent becomes an object of intensive transformative activity. The idea of nature transformation to an increasing extent wins public opinion and forms a man-made type of economic development [4]. The transition to this type of development, characterized not only by the high rates of economic dynamics, but also the appropriate increase in environmental pollution, negative impact on the environment. These processes have found detailed coverage in the study of employees of the Massachusetts Institute of technology and other scientific institutions of the United States: Meadows D. G., Meadows D. L., J. Rynders., Behrens V. "Limits to growth", presented as a report on the project of the club of Rome "the Difficult situation of mankind» [5]. The main model of the study was developed considering the doubling of initial stocks and even their increase to unlimited, birth control, intensification of agriculture and favourable indicators of other variables. It identified the need for zero economic dynamics to prevent the growth of the negative impact of economic activity on the environmental system.

In the study of M. Mesarovich and E. Pestel, presented in the form of a report to the club of Rome in 1974, the main cause of the ecological crisis is determined based on a significant gap in the economic dynamics between developed and underdeveloped countries. The development options considered in the model to overcome the crisis "Organic growth" are based on the reduction and overcoming of this gap through significant additional investment in the economy of underdeveloped countries [6].

The gradual evolution of views in the formation of models that closely link economic dynamics with environmental protection is the gradual strengthening of environmental protection measures in the process of economic development. There is a gradual transition from the minimum economic costs in the first stage in the 60-70s to the prevention of pollution in the second, and a harmonious combination of maintaining economic dynamics with the preservation of the environmental environment. In 1992, the UN Conference on the environment "Agenda 21" formulates sustainable development at the end of the XX - beginning of the XXI centuries as a combination of meeting the needs of the current generation without compromising the needs of future generations. In 2012, the UN Conference on sustainable development "RIO + 20", stated that the global environmental crisis is aggravated, and practical measures are not clearly enough, despite the well-developed strategic course.

In 1972, V. V. Leontiev and D. Ford developed the first interindustry model, which closely linked the natural and material factors of the economic system, their industry affiliation, taking into account interindustry relations and cost ratios, with the corresponding structure of the negative impact on the environment [2].

With the name of John. Forrester linked the theoretical momentum that led to an increasing stream of research under the title "global modelling". Based on the study of the interrelated unity of the world processes as a single system of industrial and agricultural production, social processes and environmental change, it is concluded that the further development of the current trends in the world system, is fraught with the inevitability of the global crisis. The basis of the upcoming crisis, according to the author, will be a contradiction between the limited natural resources of social production, the increasing needs in its volumes and the increasing processes of environmental pollution. The intensification of this contradiction will lead to the depletion of natural resources, decline in production and mortality increase. In this connection, there is an objective need to stabilize industrial production and material consumption. Therefore, it is extremely important for humanity to understand the content and nature of the interaction of subsystems that make up not a simple plurality, but the integrity of the global system: production, demographic and agricultural.

The 15-year study of the dynamics of socio-economic systems was based on the functioning of the dynamic model of world interaction during the fifteen-year period. This period was complicated by the post-war energy crisis of 1970-1975, which on the basis of the model of "war of civilizations" by S. Huntington was characterized as a confrontation of raw countries of the South against the industrial North, as well as often interpreted as a structural crisis of the post-war economic model, and the study itself contains accents on the coverage of the shadow processes of its course.

The theory and methodology of the dynamics of global development are presented in the studies of J. Forrester as a reflection of the effective interaction of economic, social and environmental systems in the most general aspects of the dynamics of the world system. The dynamics of the world model formed on this basis does not reflect all the problems associated with the general trends of global development, and therefore, many important variables had to be neglected. At the same time, each of the created models is most consistent with the time of its creation, replacing the previously created models, which were considered less accurate and require improvement efforts.

The global system at each stage of its development is faced with overcoming the contradictions formed by changes in the structure of production, uneven development between regions, changes in the number and structure of the population, differences in living standards, increasing pollution. In this connection, there is a growing awareness of the close relationship of the elements of the global system, the understanding of the dependence of changes in one sector of the system because of changes in the other. Thus, the growth of production of industrial goods and food contributed to global population growth, but also to the reduction of fertility with the growth of living standards. At the same time, the growth of production generates problems of depletion of natural resources, which requires the use of the option of transition from dynamic growth to the formation of a state of global equilibrium. Therefore, exponential growth should not be equated with progress.

Progress is characterized by the formation of a structure of mutually balancing forces at the global level, which reduces the excessive burden on the environment. The change of the old one and the formation of a new structure of the global system is materialized by the plurality of alternative options for future development, emerging due to the close interdependence and interaction of the elements of the system. The significant increase in social production with a positive dynamic of all factors of production will lead to a crisis of environmental pollution, reduce fertility, increase morbidity, increase mortality and reduce production. But this trend will be formed primarily in relation to underdeveloped countries, which are characterized by a low level of requirements for the environment protection, which entails the placement of the dirtiest industries, in areas with high population density, low level of health care and quality of life.

In 1961 the monograph "Fundamentals of enterprise Cybernetics (industrial dynamics)" was published, and in 1969 "Dynamics of city development". In the first work J. Forrester presented the theory of structures in dynamic systems, and in the second one he applied it to study the processes of growth and stagnation of urbanized regions. In further studies based on the application of modelling methods in complex systems he defines this method as "system dynamics" used for a comprehensive study of economic, social and political processes at the macro level. In the future, an even more ambitious task is set – the creation of a global model of economic systems functioning, which would be fully reflected in the processes in real systems: in countries, business, family, natural environment.

The former world models contain interrelations of variables of five levels – the population, investments in industrial and agricultural production, an assessment of available and consumed natural resources, environmental pollution its influence on quality of life, its duration, demography. These models are only preliminary, because they are embodied only in the attempts to reflect the complex processes that are inherent in real complex dynamic systems. They also contain significant flaws related to the role of the subjective factor and innovation based on it, which significantly reduces the content of the models themselves. But the experience gained of programming and the formations of system simulation models generate predictions of the future development.

At the same time, forecasting of economic dynamics should consider a number of insufficient validity of variables of system models. In this connection, the generated models reflect only the likely trends of this development. This is evidenced by the following: first, the indicators of natural resources included in the model reflect only explored reserves, but do not take into account their actual volumes; second, scientific discoveries and developments for decades have solved the problem of replacing elements of natural resources with their inorganic substitutes; third, the constant change in the structure of social production is based on the emergence and use of new technologies and constantly changes the structure of consumed natural resources, as well as allows to increase the production of their

inorganic substitutes, based on available reserves, affordable and low-cost sources of natural resources. Therefore, this variable will largely depend on the subjective factor, as well as the development of directions and volumes of innovation.

In case that natural resources, as a result of these circumstances, are not a significant constraint on socioeconomic development, the pollution of the environment is a clearly growing threat not only to limit the pace of development, the volume of products, but also such important variables of quality of life as its duration, morbidity, demography. According to global statistics, the development of the crisis phenomena of the environment shows an increase the pollution of the environment in more than 40 times since 1970. That is, the dynamics of pollution increases, approaching the corresponding indicator of the dynamics of decomposition the pollution, and surpasses it for some types of waste. It should be borne in mind that pollution is increasingly progressing in developing countries. This is due to the increase in the structure of waste products of the chemical industry, in requiring the use of processing technologies since the terms of their decomposition, especially from polypropylene and other types of food and non-food plastic, are determined from 100 to 500 years or more.

Economic dynamics of social development often generates problems, the resolution of which causes the emergence of new problems. This is due to several reasons: the solution of the problem in the current period can lead to problems in the long term; the solution of a local problem can lead to a problem for the whole system; only the illusion of solving the problem, with the corresponding costs.

### **3 DATA AND METHODS**

In the study of theoretical and methodological foundations of economic dynamics to reflect the interaction of economic, social and environmental systems used the results of fundamental theoretical studies of the relationship of the evolution of economic development and the increasing role of ecology in the interaction of man, means of production and the environment, determining the main variables in the creation of models of forecasting future development and identifying its main trends.

In the course of the study, a subjective approach was used, which determines the establishment of the active impact and interaction of business entities on the external environment, and the identification of patterns that determine the formation of the main trends in economic dynamics through the use of empirical positivism with a detailed study of economic processes and phenomena.

The most important research methods used were: analysis used to separate the process of economic dynamics as a single interrelated integral process into its separate components, to establish the features of participation in this process, to study each of these parts, to identify the essence, patterns, trends in socio-economic processes and is the starting point for the construction of theoretical models; synthesis used to determine the characteristics of economic dynamics at different stages of the evolutionary process as a whole of its individual components; induction – to identify common patterns of economic dynamics in the interaction of economic, social and environmental systems; deduction; logical and historical approaches; comparison. Thus, the methods used in the study are quite diverse, allowing a comprehensive study of economic phenomena and processes in the dynamics of development.

### **4 RESULTS**

The study briefly and concisely presents the evolution of theoretical and methodological approaches in the study of the relationship of economic dynamics and economic growth based on the interaction of economic, social and environmental systems.

It is possible to identify those features that are largely an obstacle to ensuring a close connection between the increase in the pace of economic dynamics and the improvement of the sustainability of the environmental system.

First, the development and continuous improvement of the theoretical and methodological foundations of the mechanism are closely related to the scale of economic reforms, the dynamics of changes and a set of compensatory environmental measures.

Secondly, considering the dependence of ecological identity on the development of socio-economic and environmental tools provides a solution to the environmental problem as a key problem of quality of life.

Third, the natural-adaptive determinants of economic development should be closely linked to the development of the "green" economy by its environmental sustainability and increasing the value of natural resources.

Fourth, the development of theoretical and methodological foundations of modelling provides the formation of ecosystem signals on anthropogenic impact on it in the medium and long term.

Fifth, the development of mechanisms for the spatial increase of economic capacity corresponds to the reduction of environmental load.

Sixth, the development in the public consciousness of understanding the relationship of culture of material and spiritual production is an integral part of the environment.

## **5 CONCLUSIONS**

The evolutionary nature of the dependence of economic dynamics and economic growth on the basis of the interaction of economic, social and environmental systems indicates that each new qualitative stage of sustainable development of the national economic system requires a systematic approach to the formation of a balance of these three fundamental components of socio-economic progress.

According to the authors, the achievement of the current level of material production, and the potential that is fraught with the economic dynamics of future economic growth of the global system poses the problem of interdependence of social, economic and environmental systems. The constant increase in the dynamics of socio-economic development without an appropriate compensation package of environmental measures will certainly lead the ecological system to a critical state, when the quality of life will depend on the restoration of the elements of the environment.

## REFERENCES

- [1] Gryaznova E. V., Malinina V. V. Ecological Technosphere of modern society: monograph. N. Novgorod: NNGASU, 2011. 146 p.
- [2] Leontiev, V. Interdisciplinary analysis of the impact of the structure of the economy on the environment/V. Leontiev, D. Ford//Economics and mathematical methods. 1972. Vol. VIII. Issue.3.
- [3] Reimers N. F. Ecology – theories, laws, rules, principles and hypotheses. M.: Magazine "Young Russia", 1994. 367 p.
- [4] Popkova, N. In. The main contradiction of the Technosphere // Philosophy and society. No. 3. 2005.
- [5] Meadows D. H., Meadows D. L., J. Randers., Behrens V. V. (1994): Limits of growth. Report to the club of Rome. S-Pb.: Neva-PRESS.
- [6] Mesarovic M., Pestel E. Mankind at the turning. Second report for the club of Rome. S-Pb.: Neva-PRESS. 1994.