

SYSTEM APPROACHES TO MODELING OF SUSTAINABLE REGIONAL DEVELOPMENT APPLIED THE DIRECTED GRAPHS

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The mankind has got into extremely complicated and very dangerous situation at the beginning of third millennium. The most people don't realize fully the level of threat of man's activity and destructive consequences of this activity for environment. In fact, it has brought our planet to global ecocatastrophe. This situation has made world community look for new ways of humanity evolution. The well-known document entitled "The agenda for XXI century" accepted by International environmental conference of OUN in 1992 is one of such kind of ways. A new model of social development named sustainable development has been offered by this document. Sustainable development approach combined next ideas: harmonious interaction and unity of ecological, economic and social development. For transition to a new model of ecologically safe and energy saving development, it is necessary to seek the accordance of three above-mentioned constituents of development both at world level and at the regional level.

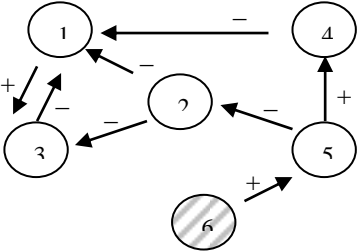
One of the methods of modeling of sustainable development is Method of System Dynamics. System dynamics is one of the most challenging directions of management consulting in the developed countries. Despite the fact that system dynamics spreads so fast in the world, this area of systems analysis and management consulting is still called "terra incognita" in Ukraine. Among the scientists that investigated the problems of sustainable development it is possible to distinguish such as Vernadskiy V., Daylami M., Dobrovolskiy V., Melnik L., Stunsler G., Tomas V. at alias. The investigations of such scientists as Gabor D., Leontiev V., Medouse D., Messarovich M., Novosselov A., Pestel E., Forrester G., Tchepurnyh N. at alias are dedicated to research of system dynamics. In spite of an important contribution of the above-mentioned scientists to investigation of these problems, regional problems of system dynamics of sustainable development keep being slitly investigated.

Founder of system dynamics is Professor G. Forrester from Massachusetts Technical Institute. The mathematical model of worldwide system described world dynamics was created by him on basis of the investigations of economic processes. The world dynamics is a new direction of mathematical modeling that is applied to solving the vitalest problems concerned with analysis and forecast of the basic world tendencies. In this model, the world is considered as integrated system of varied interactive factors. This model represent development of the world by means of the five main interdependent variables which grow fast and permanently, such as population, capital investment, use of unrenueable resources, environmental pollution and production of foodstuff. Forrester considered that systems analysis of dynamic trend of these variables would enable to forecast the behavior of the whole system in different conditions.

The scientists including Forrester used the system approaches to modeling of sustainable development at world level or at the state level. Nevertheless, every state consists of the regions, and the region is the same system consisted of indices of economy, ecology and society. Therefore, it is necessary to extend the investigations in the area of system modeling of sustainable regional development. Toward this end, it is offered by us to forecast using directed graphs the model of regional system.

The directed graph represents the convenient tools for representation of mechanism of multi-component system components interaction. The activities are used as vertices, and the arcs show the influence of activities on each other. The signs mean favorable or unfavorable influence of the components on each other. On the Picture 1, we can see the directed graph demonstrated the problem of energy saving development and environment in big industrial centre.

The method of using directed graphs for construction of model of sustainable regional development allows representing visually interaction of considered activities, to measure mathematically dependence of one activities from the others, to forecast ecological and social consequences of regional economic development. Eventually, the main point of this method is search of the opportunities of management of such complicate multi-component system.



Picture 1. The directed graph investigated energy saving development and environment in big industrial centre

1 – state of environment, 2 – emissions, 3 – population, 4 – power (energy) generation, 5 – assets of the fuel and energy complex, 6 – capital investment, as “managerial” vertex