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**Synergetic modelling of sustainable development**

ABSTRACT. This paper deals with the generalization of the problem of sustainable development, the concept of which is based on the assumption that societies need to manage three types of resource (economic, social, and natural). The field of sustainable development can be conceptually broken into three constituent parts (subfields): environmental sustainability, economic sustainability and sociopolitical sustainability. The analysis of sustainable development history in recent years shows that synergetic balance between the subfields represents a necessary condition for sustainability, the fulfilment of which depends on the entire policy. The problem cannot be solved without a systems approach, such as living systems analysis, synergetics, system modelling or complexity theory. The role of system sciences is increasingly determined from the viewpoint of behavioural modelling of the most complex system. In general, development represents system building in dynamics, but sustainability is associated with stability of the system. On the other hand, any system's degree of development can be defined as a function of complexity, including diversity. In general usage, complex systems tend to be high-dimensional, nonlinear and hard to model. Structurally sustainable development represents the treelike structural genesis of system fractals (or clusters); i.e., the hierarchy of epistemological levels, every level of which corresponds to the degree of system dimension. At the same time, at any level, the system may be considered in just two aspects: horizontal (epistemological) and vertical (hierarchical). The more complex the system (including the possibility of a multilevel structure) the more developed it is. In this paper, we present a new approach for a formal description of the complexity with respect to the viewpoint of modelling and sustainability, conditioned by the existence of nonlinear environmental, economic or other natural factors. Contemporary system models are more likely to be nonequilibrium models emphasizing the concepts of entropy and synergy. The originality of this work lies in the description of system as a form of quantum graph with synergetic edges as a superposition of fuzzy entropy and synergy. Diversity is conditioned by system homeostasis or heterostasis. In any given context, during a developmental processes in dynamics, the achievement of unity of clusters can be realized, when pairs of system clusters unite to form new single clusters, which provokes redistribution of the synergy/entropy, its balance and increasing fitness.

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