NONLINEAR DYNAMIC PROCESSES MODELING IN SYNERGETIC ECONOMICS

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Analysis of developed and developing economies of the world allows us to state that all of them function steadily as synergetic systems. There is still no exact mathematical definition of the synergetic nature of such processes. The model of synergetic of interaction dynamics of various components of nonlinear maps that describe the processes of development and implementation of innovative projects is considered and studied.

The processes of innovation projects consist of two components. At the first stage, creation of a new study technology of economic systems management and the implementation of innovative development process that is based on investing in a business plan. This process is systematically repeated in high-tech companies: a new development process – investments in a business plan - the implementation of the development in the markets and again this sequence of stages of innovation implementation is repeated at a new level. The stability of these processes must be accurately explained from the mathematical point of view. Research papers [1,5,6] contain the results of research aimed to explaine the synergetic nature of the development of economies associated with high-tech developments (Microsoft, Google, IBM, Tesla, etc.). The considerations given in these works do not always give a full justification for their synergetic nature. The authors of works [2,3,4] drew attention to the Levy factor for the first time, when the investment in the implemented project is abruptly reduced and also very rapidly allocated to the implementation of new investment (prospective) development in the same area by the same companies. This is especially evident in projects related to electric vehicles, solar power plants, system software, smartphones, information technology, etc.

Analysis of nonlinear dynamic processes in such areas allows us to formulate and prove that such synergetic processes in these companies and the entire economy as a whole always contain several nonlinear components of such processes close to the logistic model of resource consumption with the moments of restructuring in the form of Lévy flight [3], that is intermittent investment strategy change. Levi flight is one of the forms of a random walk, the graphical representation of which is shown in figure 1.

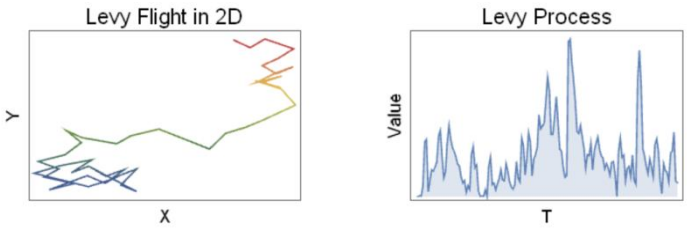

Figure 1. Representation of Levy flight model

Each component performs (implements) its contribution to the formation of sustainability. Functions of type $S_1(t)$ are the process of transferring financing from one to a completely new development. The $S_2(t)$ process is realized when, at some point in time, the implemented innovative project receives corrective financing, which leads to a reduction in the level of innovation and its gradual decline. Maps $S_3(t)$ and $S_4(t)$ describe the uniform processes of investing financial resources and their exhaustion. Graphical representation of these processes in shown in figure 2.

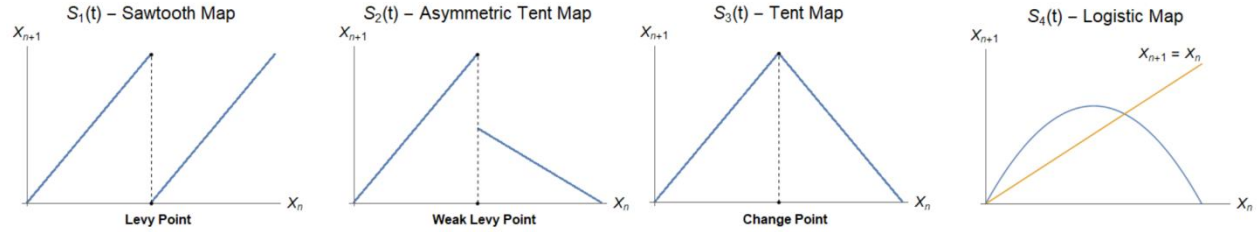

Figure 2. Presentation of investment processes

Undoubtedly, number of components of these types can be much bigger. Analysis of function S by its computer modeling and mathematical analysis with a correct choice of weight functions always provides the necessary level of stability for such types of investment management processes in all areas of developed economies and much less in developing economies. A more complete mathematical analysis of this approach and the results of computer modeling will be the subject of a separate publication.

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