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ECONOMIC CYBERNETICS

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The volume records the results of researches performed during a long time period in the field of economic cybernetics. This interdisciplinary science, with wide systemic horizon, with its arsenal of methods and simulation and economic-mathematical modelling techniques, fully contributes to the development of management science, to the practical activity of substantiating production and economic management optimization, of elaborating the prognoses of economic-social development programmes and plans, beginning with those of the enterprises up to the level of the whole national economy.

In the *first part* of this work, the mechanism of planned management of economic-social development is analysed, laying emphasis on the decisive part payed by the decision adopting strategy in convergently directing all human, material and financial resources of the nation. *The single national plan of economic-social development* — synthesis of the fundamental political decisions of optimal, balanced and proportional economic growth — represents the most complex social control, expressing the unity of will and action of the whole nation. The single national plan represents the prospective model, through which the coordinates of the economic growth trajectories of all national economy system components are traced.

By bringing out in bold relief the essential attributes of the national, single, indivisible and all including plan, its elaboration process is described, and the important part devolved upon the prognosis elaboration activity is emphasized.

In the second chapter, the role of cybernetics as active factor in society's general progress is analysed. Cybernetics obviously intensifies and makes complete the whole scientific research with new methods of investigation, and contributes to the enrichment of elaboration and substantiation techniques of the optimal production growth decision-making models. The gnoseologic functions of cybernetics, the new investigation valences it emphasized, obviously enhance the scientific arsenal, turning to a social management scientific instrument, on the plane of research and economic practice.

The use of cybernetics of production processes of economic management, the continuous introduction of technical progress represent catalyzing elements with a view to speeding up economic growth, goods production, labour productivity, the whole economic efficiency, for increasing the wealth of the nation and the people's welfare.

It is emphasized that cybernetics objectively appeared as a result of the century-old evolution of human knowledge. Cybernetics and economic cybernetics genesis, respectively, is sinthetically presented, and its roots are thrown into relief, which start from the antiquity's thought

and have as a decisive inflexion point the dialectic and historical materialism. Economic cybernetics — a most important branch of cybernetics — which elaborated and substantiated concepts, models, methods and techniques of qualitative-quantitative investigation of the optimal, balanced and proportional growth of the national economy system components, appeared as an objective necessity, generated by the continuous amplification of the social life complexity, of the rapid development of production forces, of the national and international labour division deepening.

The *second part* of the work presents the concepts, methods and techniques of economic cybernetics.

Economic cybernetics represents the management science of the complex, alert and continuously perfectible cybernetic-economic systems, within which man, as a decision-making and execution factor, holds the decisive place. Starting from this principle, the cybernetic-economic system concept is substantiated.

Cybernetic-economic systems, qualitatively differentiated from other classes of systems, contain as an essential element *the direct and conscious man's presence* in the command-decision-making functions and their complement, the control-adjustment functions. The achieving mechanism of those functions has as main target the maintaining of the system on the planned growth trajectories, taking into account the influence factors, both from within and from without the system.

The intensity of the activities of *production, scientific research and technological engineering of designing*, of preparing and improving man power, of prognosis and planning a.s.o. that take place within every cybernetic-economic system is determined by *the input vector* into the system.

The results of the activity carried on in the framework of each cybernetic-economic system are materialized in labour, raw materials and materials, energy, fixed assets, informational and financial flows which, as a whole, make out *the output vector* from the system.

Economic cybernetics studies the properties of the cybernetic-economic systems, the dialectic concept of *connection*, which expresses the links through which the components of the system are connected and interconditioned, on the basis of labour, material, energy, information and financial flows. By analysing the concept of connection and that of feedback, the adjusting mechanism is rendered under the form of equations, on the basis of *the feedback law*.

The connections between the system's elements are defined on the basis of the connection matrices and order relations.

The author defines a cybernetic-economic system with the aid of following elements:

— the set of system's elements;

— the definition set of connections;

— the set of national economy components, which are in connection with the system;

— the set of national economy components connected to the system;

— the space of input vectors into the system;

— the space of output vectors;

— the vector functions which render the functional dependence between inputs and outputs and those that render the evolution of states under the action of outputs.

The cybernetic-economic system is defined by the dialectic interaction between its structure, behaviour and functionality in the framework of the economic mechanism.

The 4-th chapter defines the *general cybernetic system of national economy* which has as component elements all the systems and subsystems of national economy. The general cybernetic system structure is extremely complex, as it has a great number of components, grouped in hierarchical structures, both on the vertical and on the horizontal, over the whole territory.

The national economy general cybernetic system's components were structured in three great systems categories: synthesis systems, effectory economic systems, final-cumulative systems.

Within the synthesis system group there are:

— the single management command, control, adjusting system;

— the economic informational system;

— the labour productivity system;

— the efficiency-profitability system;

— the financial and prices system.

The specific feature of each synthesis system group's component is that it covers all the space of the national economy as it is in a relation of cybernetic homomorphism to the whole national economy general cybernetic system.

The effectory economic system group includes:

— the population and man power system;

— the scientific research and technological development system;

— the goods production and services system;

— the international economic relations system.

Within the final-cumulative system group, one must notice:

— the social product and national income system;

— the national wealth system;

— the nation's welfare system.

The efficiency of all activities which take place within the national economy system is estimated on the basis of their contribution to the growth of the national income, national wealth and welfare of the nation.

The 4-th chapter also analyses the main connections, as well as the national economy system's map, emphasis being laid on the central feedback from the national economy space.

In the 5-th chapter, *the concepts of economic space and of economic time* are presented. In the vision adopted by the author the economic space concept is a generalized representation of the cybernetic-economic systems' characteristics, and it synthetises their defining characteristics.

The space of the national economy represents the reference environment of the national economy general cybernetic system motion in the complex process of planned economic growth. It reflects the totality of the phenomena taking place within the economic mechanism, the ratios and interdependences built up between the national economy system components in the complex process of their development. Through the agency of the parameters which characterize the optimal, balanced and proportional economic growth process, the co-ordinates of the national economy space reflect the results of all the economic activities carried on by the components of the general cybernetic system, as well as their growth potential. The national economy space is unitary and indivisible.

If Φ denotes the space of the entirety of inputs, X, the space characterizing the states of all national economy general cybernetic system components, and ψ, the whole lot of outputs, the national economy space is defined by the triplet $\{\Phi, X, \psi\}$.

In close connection with the economic space category is the category of *economic time* — the generalized image of the time duration of carrying on economic processes, of the intervals between them. The economic time category reflects the totality of the succession or simultaneity ratios of the processes and economic phenomena, the duration and rhythms of the activities taking place within the economic-cybernetic systems, synthetizing the socio-economic dynamism development.

At the same time, the *optimal economic time* concept is analysed, which takes into account the optimal succession and synchronization of all characteristic activities and processes carried on by the national economy system components. The optimal economic time concept represents a cybernetic reflexion of the time saving general law — the most precious resource within the framework of the national economy system.

In the last paragraph of chapter 5 a general economic-mathematical model is presented, in spatial-temporal co-ordinates, of the optimal development process of the economic-cybernetic systems.

During the multilateral investigating process of the dynamic properties of economic growth prospective trajectories, of the motion laws of cybernetic-economic systems within the national economy space, the necessity of developing a new branch of cybernetics — *the economic logistics* — appeared, whose methods and techniques are presented in chapter 6. The concepts of *dynamic optimum*, *optimal trajectory range*, as well as *the ensuring mechanism of the cybernetic-economic system growth* in the range of planned trajectories, synthetised in the triad: command-control-adjustment. At the same time, the topological proper-

ties of the observableness, accessibility, growth zones, as well as of adjustableness in the national economy space are analysed.

The work presents logistic methods and techniques for designing cybernetic-economic systems optimal economic growth trajectories, based upon the Principle of maximum, for dynamic systems with delayed discrete variables, as well as for analysing the logistic properties of optimal, balanced and proportional economic growth analysis.

Chapter 7 presents the problems of the *Quantic economy*. The basic problems studied by the quantic economy concern the laws of *dynamic balance* within the national economy space, *the entropy* and *gravitational properties* analysis, the emphasizing of the specific mode of action of the *propagation* and of the *driving* phenomenon, as well as the building up and the manifestation of the conditioned *reflexes* in the economy.

The economic growth process analysis reveals the fact that the evolution trajectories of the cybernetic-economic systems represent the vectorial resultant of three components which characterize the motion in the national economy space: *the trend*, *the wave motion*, *the random component*. After the analysis of each component specificity, corresponding equations are given.

The quantic economy studies the motion laws in the space of the national economy, its wave components, the action mode of their propagation and driving effect, with a view to substantiating the directing and adjusting the cybernetic-economic systems, to quantifying the conditions ensuring the permanence of the dynamic balance of the growth trajectories from the national economy space.

Starting from the materialist-dialectic thesis of the unity between necessary and aleatory, the concept of *entropy of growth probalistic space*, which quantifies the cybernetic-economic systems dynamism, is specifically defined.

The defining mode of the entropy concept allowed to represent through equations the *gravitational phenomena* in the national economy space. This presents a particular importance in view of identifying the cybernetic-economic systems which play a propulsive part and serve to impel and accelerate the whole process of economic growth. At the same time, mathematical representations were obtained, which allow to quantify the driving force intensity or the gravitational force of the cybernetic-economic systems, respectively.

Chapter 8 is reserved to the analysis of the cybernetic-economic modelling problems, and it also synthetically presents the genesis of the concern for quantifying and modelling the economic processes. The cybernetic-economic processes are classified on the basis of three criteria: the covering sphere, the reflected attributes, the time horizon they refer to.

In the third part the 12 basic components are distinctly analysed, wherein the general cybernetic system of the national economy was divided.

The functionality of every system within the economic mechanism and the role it plays in the whole process of economic growth are identified. Concomitantly, the composing subsystems of each system, the direct connections and feedbacks between them, as well as the connections with the other systems in the national economy space are analysed.

For each composing system of the national economy general cybernetic system, *economic mathematical models were devised*, which describe their behaviour and functionality in the framework of the optimal, balanced and proportional economic growth mechanism.

A particularly important part is played by the *management cybernetic-economic model.* As a construction of maximal synthesis, the management cybernetic-economic model concentrates and processes the main elements obtained through solving all systems in the national economy space. The output variables of the management model represent the decision-making parameters which define the co-ordinates of the systems evolution trajectories in the *general progress area.*

The synthesis of the optimal command of the management cybernetic-economic model represents the *logistic equation of management.*

The concrete mode in which the single management, command, control and adjustment system determines, on the basis of the management's logistic equation, the optimal decision vector for each stage represents the *management algorithm.*

The co-ordinates of the optimal, balanced and proportional economic growth, are pointed out by the *equation of the future*, also resulted from the synthesis of the management model optimal solution.

There is a very strong connection between the management logistic model and the *economic-mathematical model of optimal distribution of the national income for accumulation and consumption*, presented in chapter 18.

Also a strong connection is formed between the management logistic equation and the equation of the future, on the one hand, and the *national health growth equation*, on the other hand. The national growth equation (chapter 19) — a cybernetic representation of powerful synthesis — reflects the optimal growth process of the national health system components: the human resources subsystem, the natural resources subsystem, the accumulated material goods subsystem, the nation's creative potential subsystem. This equation renders evident the efficiency of all activities carried on in the national economy space and the growth potential of the general cybernetic system.

The nation's welfare growth equation, presented in chapter 20 synthetises the finality of all growth trajectories of the systems and subsystems in the national economy space, their effect upon the growth

of the people's material standard and cultural level — the basic target, the supreme reason of the whole dynamic and speeded-up development politics of the national economy.

In the last chapter of the work, the principles laying at the basis of synthetising the economic-mathematical models of the national economy system components in a system integrated by models, is presented.

The examination of the volume points out that we find ourselves in the presence of a work wherein, for the first time at world's level, the economic reality is looked at from viewpoint of an economist with complex formation: his scientific, materialist-dialectic vision, is combined, in a happy manner, with his cybernetic-mathematical vison, surprising in this way the extraordinary complexity of the phenomena specific to economic life.

For the first time in speciality literature, this work puts at the disposal of specialists and students a comprehensive material concerning economic cybernetics. It is necessary to stress especially the deeply original character of this work, the author's materialist-dialectic vision on the multiple and complex economic phenomena and their approach in a systemic concept of wide prospective horizon.

The new concept methods and approaching techniques of the economic phenomena, brought in by the author, are the result of a long-time experience in the field of economic-social activity, of a remarkable mastering of the cybernetics science.

The publication of the work of Economic cybernetics will contribute to the development of research and to the applications of methods and techniques using cybernetics of economic administration, to the continuous improvement of the management and economic-financial planning in our country.

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