Conclusion

One of the main issues—and opportunities—in economic development is higher management standards at every level. However, it is impossible to achieve high management standards and to make strategic and tactical decisions without twenty-first-century instruments based on solid mathematical models and methods.

The set of new economic-mathematical methods and models suggested in this book are structured as information support systems for making decisions in problems of budget control, economic efficiency of production systems, currency exchange, and assessment of investment projects and investment decisions.

An analysis of existing practices of budget process modeling reveals a lack of efficient mathematical models for making calculations and forecasts and controlling financial flows. In order to structure and understand functions and organizational budget systems, a unified budget classification system has therefore been established and models of budget knowledge representation have been constructed. A mathematical budget model based on the matrix of interaction of income and expenditure items is presented in the first two chapters of this book. The matrix elements are equal to the ratio of the expense vector elements to the income vector elements. The differential of the budget equation shows budget sensitivity to changeable (controllable) parameters. Statistical processing of the experimental data confirms that the model adequately describes factual budget performance. The model can be used in an arbitrary section of budget classification and in any discretization period. The method of program control is detailed here, along with models for correcting program control and assessing program decisions, the dynamic model controlling flows of budgetary funds, and the information system controlling financial budget flows.

Entropic estimation of the state of production system parameters makes it possible to estimate changes in parameters by a single relative indicator, and to synthesize such estimations into a unified economic image of the current production situation. In the real production conditions at a certain moment of time every value of the state of a controlled object corresponds to a certain value of entropy. As entropy is defined by a quadratic form, by knowing its value for a certain article one can determine the efficiency of its production with respect to other articles. Based on the mathematical statement on reduction of quadratic forms to the canonic form, the

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method developed in the third chapter can be used for comparison of several single-type productions. More exact values of quadratic forms mean that this approach is justified mathematically and is applicable for assessment of production systems.

Methods and mathematical models of processes on the currency exchange market are analyzed in the fourth chapter of this work. A mathematical model of balanced exchange rates is presented and analyzed, and balancing problems are formulated and solved. Collocation models presented in this chapter are universal and can be used to solve tasks of exchange market forecasting. Information about expected exchange rates can be obtained by extrapolation. A high degree of information justification makes it possible to identify closed sequences of currency purchase–sale operations giving speculative profit. To facilitate the adjustment of exchange rates by second-level banks, an information system for supporting decision-making is also presented.

To improve the quality of assessment of innovation projects, existing methods of project assessment are analyzed in chapter five. Criteria and methods for assessing innovativeness and competitiveness are developed, along with a graphic model allowing visualization of project assessment in the coordinate scale of the matrix model. Innovation projects being objects of two interacting segments—science and business—are formalized as two-dimensional objects with the dependence $K = f(I)$, where K is competitiveness and I is innovativeness. The chapter establishes a method for estimating realizability and economic efficiency of innovation projects and presents a graphical model based on indicators of pure reduced cost, internal profitability rate, pure profitability index, and payback periods. This model facilitates complex project assessment on the basis of absolute positioning. The corresponding decision support system provides a program-targeted approach leveraging complex expertise in project assessment by such parameters as innovativeness, competitiveness, and economic efficiency. This decision support system is designed to be utilized by expert commissions responsible for venture funds, development institutes, and other potential investors needing to select appropriate innovation projects.

Chapter six explores the methods and mathematical models used to make investment decisions, which form a complex methodology for assessment and choice of multi-dimensional investment project alternatives. Today's financial management is characterized by active implementation of investment projects where it is necessary to forecast not only time structure of payments and their concrete sums but also probabilities of possible deviations from the expected results—that is, to estimate the degree of risk. Computer and measuring support of mathematical modeling expands the possibilities of practical application of the methods and models suggested here.

Chapter seven studies the multi-objective stochastic decision-making models on resource allocation. Constructing methods and models for the distribution of resources is a rather important direction of modern science. Under the condition of incomplete information, combined target functions, built on the classical principles of choice, are used for the analysis and simulation of the distribution of productive and investment resources for regional and industry development.

Mathematical methods and models for monitoring government programs are considered in chapter eight. Such methods and models are aimed at improving the efficiency of the implementation of governmental programs and the transparency of their execution, and also increasing the efficiency and validity of management decisions by the program administrators. The implementation of management technologies to monitor the realization of the governmental housing program will let us improve the evaluation of performance costs, that characterize the achievement of governmental policy aims by the administrator during the process.

The final chapter studies methodology for the identification of competitive industrial clusters. The modern development of Kazakhstan has a distinctly regional context. There is a need to cluster regions of the country according to similarity in economic development, in order to create a dual regional policy, that takes into account differences between groups of regions (regional clusters) and aims at developing not only separate regions and regional clusters, but also the whole territory of the country. The combined technique of Kazakhstani regional cluster analysis consists of assessing the economic level of development and identifying industry-drivers in the region, developing on the level of competitiveness. This constitutes the kernel of a potential industrial regional cluster, and accelerates the pace of economic growth of the area.

Thus, the mathematical models and methods proposed in the book are effective mechanisms of forecasting, synthesis and analysis, and support management in the appropriate spheres of application of economic industry.

About the Author

Galym Mutanov graduated from the Kazakh Polytechnical University where he specialized in "Automatics and Telemechanics" and received two years of scientific training at Moscow Institute of Steel and Alloys. Mutanov took post-graduate and doctorate courses at Moscow State Mining Institute. His Candidate and Doctoral dissertations were devoted to the theory and practice of automated control of technological processes with use of elements of artificial intelligence. Mutanov is the author of over 400 scientific publications, monographs, textbooks, manuals, and inventions in modeling and control of social and economic processes. His works have been published in the USA, Czech Republic, Sweden, Greece, and Switzerland. Mutanov has trained more than 40 doctors and candidates of sciences.

Galym Mutanov has a State Award—order Parasat. He is an Honored Worker in science and technology of the Republic of Kazakhstan, Honored Worker in education, Honored Engineer of the Republic of Kazakhstan, and a full member of international academies. His awards include the grant from the Kazakh Academy of Sciences for outstanding scientists, a silver medal from the International Bibliographical Center (Cambridge), the gold medal "The United Europe" (Oxford), "Name in Science" International medal (Oxford), Medal "For outstanding achievements in science and innovation" of Lisbon Higher Institute of Engineering (Portugal), and Chevalier L'Ordre des Palmes académiques (Ministry of Education, France). Mutanov is a member of the Monitoring Committee of the International Society on Engineering Pedagogics (IGI, Freeburg), President of the Central-Asian IGIP Branch, a member of the UNESCO Steering Council on Information Technologies in Education (Paris), a member of International Association of University Presidents (IAUP), a member of Econometric Society and a member of Royal Economic Society, Pres-

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