Manea Mănescu, Anatol Măcriş and Vincenţiu Dumitru

METODE MATEMATICE MODERNE APLICATE ÎN ORGANIZAREA ŞI PLANIFICAREA LUCRĂRILOR DE CONSTRUCŢII ŞI MONTAJE

(Modern Mathematical Methods Applied to the Organizing and Planning of Construction and Assembly Works)

Editura Academiei R.S. România, Bucureşti, 1969

It is gratifying to note that, lately, scientific investigation on the utilization of mathematics in the analysis of economic phenomena focusses its attention to an ever increasing degree on the concrete problems related to the activity of the various sectors of economy. A particularly instructive example is set up by the recent book by Prof. Manea Mănescu, corresponding member of the Romanian Academy, Anatol Măcriş and Vincenţiu Dumitru *Modern Mathematical Methods Applied to the Organizing and Planning of Construction and Assembly Works.*

This book enjoyed particular success among economists on account of the problems of present interest which are dwelt upon. We need — in my opinion — more and more works of this kind, since a more direct contact between practical and economic investigation would thus be made easier; I must confess that, in our country, there are so far only few studies in which such a close blending has been achieved between the theoretical concepts and their applications in economic analysis and programming, as in the present work. I must in the first place point out the scientific competence with which a series of fundamental problems of operational investigation are expounded and examined; the authors have succeeded, by a judicious selection of the material, to present multilaterally this modern branch of mathematics — of great expectations — in a relatively restricted space. It is sufficient to mention that the book includes elements from set and graph theory (classes of graphs, Hamiltonian circuit and path, the assignment problems, communication networks, Euler cycles, alternating chains, planar graphs, critical path method), determining the optimal solutions in problems of distribution, transport and stocks, queueing theory, dynamic program-

ming, theory of strategic games, Monte-Carlo methods and Markov chains. The way these problems are treated has, in itself, an intrinsic value, being based on the most valuable speciality studies so far published (in our country as well as abroad) and on the authors' own research endeavours, and also enjoy good systematizing of the ideas; all this has enabled to achieve a happy blending of conciseness in expounding the problems with strictness in their scientific analysis, which — I am convinced — represent one of the most conspicuous qualities of this book.

What seems to me essential, however, is the permanent endeavour to make prominent the domains of application of operational investigation in the construction-assembly activity, to point to the concrete problems for which, with the help of these investigations much more efficient solutions can be found than those obtained empirically. Actually, none of the methods studied stops at the level of general, abstract considerations, but it is transposed in terms of real economic activity. With this aim in view, the authors have sometimes preferred — and I believe they have been right in so doing — to summarize the theoretical analysis of the operational methods to their basic elements, concentrating, however, on their applicability in practice.

The circle of concrete problems tackled is wide, comprising fundamentally the main features in the construction and assembly activity. The new systematizing of the material according to technical and economic criteria (in this book, as it was only natural, its organizing was achieved in a way corresponding to the main chapters of operational research) is entirely conclusive. The problems of preparing construction and assembly works hold an important place in this study, the theory of communication networks and of linear stochastic networks being used to this end. Several operational methods among which the critical path method and the queueing theory are applied in programming the assembly. The application of the critical path method in optimizing the duration and cost of the works is of particular interest. The study deals not only with the organizing of construction and assembly works, but also with problems of programming and utilizing the technical means and equipment; in view of solving them more efficiently, the possibilities offered by the minimum transition method, the algorithm of distribution problems and the Monte-Carlo method are illustrated. Likewise, important aspects are examined concerning the repairs and maintenance activity: determining the optimum program if travelling repair workshops, distribution of the maintenance and repair crews, and the organizing of this activity on work sites. The problems related to stores and stocks should also be mentioned: the organizing of a store of technological equipment, the application of Euler cycles in organizing the control of material stores, the use of dynamic programming in probabilistic cases for optimizing the strategy of spare parts stocks, the computation of storing areas for technological equipment on assembly sites. The problems of transportation, whose part is essential in construction, are also treated in detail: determination of the optimum flow in a transportation network, the programming of transportation in

work sites, the organizing of communication networks on work sites, the optimization in the transportation of materials from the producer to the user. Some examples of the utilization of operational methods in the control of works are nevertheless present, though to a smaller extent. My attention was particularly drawn to investigations in the domain of organizing construction works, including the activity required for their management such as: the study of the flow chart representing operative management (through a dispatcher) on work sites, the organizing of the information system, operative planning, application of the game theory in reaching a theory concerning the organization on work sites. In all these problems, the study displays high efficiency of operational research as an instrument for improving economic activity; I therefore take the liberty to quote from the foreword to the study, where the authors write: "We believe that the material presented can inspire ... new research in the application of these methods as well as in other spheres of activity."

Obviously, in view of expressively illustrating the peculiarities of some operational methods, not all the problems are formulated in conditions fully similar to those existing in economic life; nevertheless — and this is the clear advantage of the present work in comparison with other studies dealing with the application of modern mathematics in economy — many of the examples used are "realistic", sometimes originating from practice proper.

Before closing the above brief reflections, I must point to the scientific accuracy of the style used in the study, the coherence and accessibility of the explanations which accompany all the examples analyzed and the thoroughness with which the annexed specialty references have been drawn up.

Prof. Dr. E. Dobrescu