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Trends and Developments in Research Activities in the Field of Economic Computation and Economic Cybernetics

In contemporary society science is increasingly becoming an essential constituent of productive forces.

The X-th Congress of the Romanian Communist Party envisaged the rapid progress of our country on its way of completing the socialist construction, and consequently developed an adequate and particularly well-defined plan, whose basic aim is the continuous widening and improvement of Romania's technical and material basis, the building of a multilaterally developed socialist society. The achievement of future developments in the entire political, economic, social and cultural life of our country, of the major paths on which Romanian society is to progress during the following period, assumes an intensive increase of productive forces, the creation of an advanced economy, of a modern industry and agriculture, the steady expansion of science, education and culture — i.e. the fundamental elements of progress and civilization —, the development of the necessary conditions with a view to increasing the material and spiritual welfare of all working people, the distribution of goods produced by society in the spirit of social rightfulness and equity, as well as the continuous improvement of production relations, of social organization, the achievement of the organizational background giving a chance to each citizen to be active in the field of social life and allowing the increasingly direct participation of the working people in the country's affairs management, the expansion of liberties and the development of socialist democracy.

The fulfilment of this vast programme will contribute to the national economy structure improvement, to the marked growth of some modern branches, closely related to contemporary technical and scientific progress,

to the higher utilization of material resources and of labour's technical skill, as well as to social work productivity increase.

Complex measures are being carried out and generalized in Romania in order to continuously improve our society's organization, as well as national economy management and planning. These measures take into account the fact that under the present tehnical and scientific revolution, economic development is highly dependent on the rise of scientific and technological capability, on the ability of most efficiently introducing the achievements of science and technique into the economic and social practice. The wide promotion of technical progress in national economy, the further extension of modern technology applications, the introduction of mathematical methods and computation techniques in production and management activities, as well as the manufacturing of a wide range of data processing equipment, require an increased contribution from scientific research and original ideas generating activities.

Under the rapid technical evolution, when the sophistication of phenomena and processes taking place in the economic area and, more generally, in the field of social life is increasing, considerable information is needed in order to achieve a thorough scientific knowledge, to ascertain the optimal values of most important economic parameters, to secure adequate conditions for an economic progress on optimal growth paths. The scientific tackling of methods for economic activities planning and management — starting with the assignment of production tasks per machine in industrial departments up to the ascertainment of optimal development plans for national economy through planning models, from the organization and control of scientific research in view of obtaining results characterized by a maximum return on investments up to the consciousness of the demand level on world markets — these being only some of the present research purposes —, requires the collection, recording, transmission, storage and processing of tremendous amounts of information.

The improvement of the planning methods, the economic information system, the supplies and sales system, the industrial enterprises management, the financial and banking system, as well as the design and research activities require an extension of the computation techniques and the gradual building up of a national system of data processing. As a result, research in the field of applied economics will be particularly orientated towards economic processes planning, management and organization methods, based on up-to-date computation and data processing means; research in the field of economic cybernetics, economic informatics and enterprise management will be further extended. A priority scientific research programme of national significance will be concomitantly developed, as well as the programme concerning the extension of mathematical methods and the application of operational research in the area of national economy.

Starting from the fact that by further enriching the stock of mathematical methods and computation techniques, new prospects are available and the most sophisticated economic phenomena become accessible to accurate research, a great number of Romanian institutes and centres devote their efforts to the scientific activities in these modern fields of concern. An exhaustive listing of these investigation fields exceeds the scope of the

present paper, so we shall cite as an illustration the utilization by computers of mathematical logic and algebraic methods, the surveys concerning the fundamentals of programming systems and algorithmic languages, the development of automatic numerical analysis techniques, linear programming and discrete variable programming, as well as the computerized solution of economic computation problems.

In directing its activity towards the technique of cybernetic models design, the application of operations research methods in economy, as well as towards the programming systems and digital computation, the Centre of Economic Computation and Economic Cybernetics has set as a goal the merging of its research activity with the backing of the staff training process in the field of economic phenomena analysis and modelling. Thus, the Centre of Economic Computation and Economic Cybernetics, the Faculty of Economic Computation and Economic Cybernetics and the relevant chair make up a complex research, education and laboratory practice unit. In its activity, the Centre of Economic Computation and Economic Cybernetics has received permanent assistance from the Academy of Economic Studies and from the Central Board of Statistics, and there is a close collaboration among these three bodies.

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The many data and facts resulting from our and other countries' economic practice point out that a special significance is incumbent on the introduction and promotion of computation and analysis mathematical methods, as well as the wide use of the electronic computation techniques, which render possible the solution of highly complex problems, the short-term carrying out of several planning projects and the ascertainment of optimal solutions.

It is currently a well-known fact that the in service computation potential tends to be doubled each year, while the value of in service computation systems is doubled every two or three years. This development is closely related to the extending application area; the use of mathematical methods and of computation techniques increases the profitability associated to economic activity organization and improvement studies, an important means of approach for scientific thinking to industry. In this field, in economic analysis, both at the enterprise level and at the branch or national economy level, a special significance is bestowed on economic systems modelling, on operation research methods development, as well as on economic informatics.

Already during the early years of institutions and centres devoted to investigating quantitative methods and economic computation in economy, an investigation field was outlined: the modelling of cybernetic systems in economy, in the planning and management of micro and macroeconomic processes with direct connections and feedback control. Under such terms the research carried out in the field of economic computation and economic cybernetics plays a prominent part in society's material production development, in enterprises modernization, in technological processes automation and in production optimization, which are all aimed at ultimately increasing the productivity of social work. In this respect, current

economic activity makes us grant particular attention to designing and using the most up-to-date information techniques and systems, to setting up adequate mathematical and cybernetic models subject to modern computation equipment processing, with a view to optimal decision making.

Similar to other scientific areas, the extension of cybernetic concepts in economy leads to valuable results. Although having a rather short history, economic cybernetics is quite a valuable tool for control and for the optimal management of economic processes, conceived as cybernetic systems.

In agreement with the subject matter regarding economic cybernetic systems modelling, the scientists at the Centre of Economic Computation and Economic Cybernetics aim at developing short-, medium- and long-term economic growth models for our country; on this basis, a set of basic monitoring parameters for national economy development can be ascertained, such as the optimal accumulation rate and the share of investments in the first sector. Research has been undertaken in order to develop such models, and some results have already been obtained. Starting with the specific reality existing in Romania, the conclusion has been drawn that long-term economic growth models with discrete variables are more adequate for macroeconomic planning. Consequently, a number of one-sector, two-sector and multi-sector models with discrete variables have been developed and analyzed. Furthermore, some models with lag parameters, optimum and macroeconomic balance problems, a.s.o, have also been investigated.

Another major concern prevailing at the Centre of Economic Computation and Economic Cybernetics refers to the development of operations research methods. In this field, we can mention the studies regarding post-optimization and parametrization in linear programming, the solution of linear programming problems with several optimum criteria, the development of new algorithms in the graph theory and critical path analysis, a.s.o.

The entire experience gained up to now points to the essential part played by economic informatics in the improvement of planning and control methods at all levels. The imperative requirement to process an ever increasing information volume in the most diversified areas leads to the unprecedented development of the electronic computation technique. The electronic computer has become one of the fundamental tools in economic processes and phenomena planning, in industrial production management and in the complex automation of technological processes, in scientific research and designing, in transport co-ordination, in constructions and agriculture, as well as in numerous other sectors. While in its early years it played a subsidiary part, informatics offers at present not only the general methods used in many disciplines, but also — it can be said — a general mode of tackling the applications, a mode characterized by the numerical definition and process analysis through computation models.

Within the general area of economic informatics, the purpose of decision making informatics is information classification and processing, the selection of representative information and the use of algorithms with a view to improving the decision making processes. A working tool of a particularly wide use is the structure analysis at a given time and the analysis of the time progress of an economic process, through the representation in the form of a graph. Certain amounts of information and ways for transforming

them are defined for the arcs and nodes belonging to such an information graph.

The enterprise is a typical example of economic unit; its cells are described by various departments and divisions; the purposes aimed at refer to the achievement of production assignments within the planned interval. The information and resources included in a cell of the economic unit make up the input flow, while the resulting information and resources make up the output flow. In a first general view, the cybernetic model of the economic unit is significant as it points out a need for feedback control and requires the economic process quantification. Obviously, the effective mplementation assumes the input and output measurement to be feasible, and the interfering changes (production jobs, etc.) to be known.

The economic unit operation control is an essential requirement, and in this respect the cybernetic model is of real use. In order to effectively utilize it, a detailed survey of the transformation process taking place within the system is needed, in other words the „black box" analysis is required. This is imperatively achieved by proceeding step by step and thus determining the changes to be inflicted upon inputs in order to obtain the desired results.

In the field of economic informatics problems, the development of algorithms and programming systems useful for solving various economic cybernetic problems is being studied at the Centre of Economic Computation and Economic Cybernetics. Some interesting results have already been obtained concerning the computer programming languages, as well as in the study of translating methods. Programs have been drawn up for the application of the PERT/TIME method, for the solution of linear programming and transport problems on the NEAC 1240 computer, etc. A guiding idea for the further continuation and development of all these concerns is that numerical analysis has to be studied by taking into account computer programming and, accordingly, the latter makes available a means for the deepening of the computation processes'structure.

Moreover, the activities at the Centre of Economic Computation and Economic Cybernetics are orientated towards the achievement of development projects, by approaching the problems referring to the scientific organization of production and work. Scientific and technical aid was granted to economic enterprises in order to solve specific problems arising in various departments of national economy, such as the optimal assignment of production tasks at an industrial branch level, determination of the optimum production capacities at the enterprises belonging to the mechanical engineering industries, optimization of capital investment plans and of the production zones for agriculture, finding of the major correlations of the

metal base, the utilization of mathematical methods and modern computation techniques in production operative programming, a.s.o.

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With a view to introducing and efficiently using the computation technique, a great number of experts is necessary. The education and training of personnel in economic enterprises and institutions, through formal courses, seminars and lectures, is another permanent concern of the Centre of Economic Computation and Economic Cybernetics. In collaboration with the Faculty of Economic Computation and Economic Cybernetics, belonging to the Academy of Economic Studies, during the year 1968 the first postgraduate courses for system analysts were organized and the attendance amounted to forty students.

The three major investigation areas engrossing the staff at the Centre of Economic Computation and Economic Cybernetics, namely economic modelling and simulation, operations research and economic informatics, are reflected in the plan for scientific research. The elaboration of the themes included in the research plan is achieved through the collaboration of scientists from the Centre of Economic Computation and Economic Cybernetics with the staff from the faculty of Economic Computation and Economic Cybernetics, as well as with members and experts from economic enterprises, ministries, central organizations and research institutes. The themes were selected so that they could satisfy both the immediate and future requirements. In 1968, two of the research themes of the scientists working at the Centre of Economic Computation and Economic Cybernetics were included in the State plan:

— The production process optimization and the analysis of the information system at the Ploieşti Petrochemical Works (Brazi).

— Methods for developing a dynamic model of the interindustry balance and its qualitative properties.

In the same year, experts from the Centre of Economic Computation and Economic Cybernetics, together with experts from the Ministry of Chemical Industry, developed a theme referring to the setting up of mathematical models with a view to finding the optimal utilization variant of the investment fund allocated to the development of the chemical fertilizer industry, as well as to the optimal utilization of raw materials in this important department of national economy.

The scientific research plan of the Centre of Economic Computation and Economic Cybernetics is orientated towards turning to good account the research activity, through contracts and practical applications so that the necessary conditions are secured for going over to the self-subsidizing organizational form.

TENDENCES ET CONCEPTIONS DANS L'ACTIVITE DE RECHERCHE DANS LE CALCUL ET LA CYBERNETIQUE ECONOMIQUES

La Roumanie est en train d'appliquer et de généraliser un ensemble de dispositions concernant le perfectionnement continuel de l'organisation de la société, de la direction et de la planification de l'économie nationale.

Le perfectionnement des méthodes de planification, le système informationnel économique, le système de l'approvisionnement et de l'écoulement, la gestion des entreprises industrielles, le système financier des banques et les travaux de projections et de recherches imposent l'extension de la technique de calcul et la création progressive d'un système national de traitement des données.

A cette fin, les recherches dans le domaine de l'économie appliquée seront dirigées à l'avenir surtout vers la promotion des méthodes de la planification, de la direction et de l'organisation des processus économiques utilisant les moyens modernes de calcul et de traitement des données. Aussi, il sera nécessaire d'étendre les recherches de cybernéthique économique et celles d'informatique économique, de direction et de gestion des entreprises. En même temps, il sera élaboré un programme prioritaire de recherche scientifique d'importance nationale, y compris un programme d'extension de l'application des méthodes mathématiques et de la recherche opérationnelle à l'économie nationale.

Le Centre de Calcul Economique et de Cybernétique Economique dirige son activité vers la technique de l'élaboration des modèles cybernétiques, vers l'application des méthodes de la recherche opérationnelle à l'économie et des systèmes de programmation et de calcul numérique.

ТЕНДЕНЦИИ И НАПРАВЛЕНИЯ НАУЧНОЙ РАБОТЫ В ОБЛАСТИ ЭКОНОМИЧЕСКОГО РАСЧЕТА И КИБЕРНЕТИКИ

В Румынии в настоящее время проводится ряд мероприятий по внедрению, обобщению и дальнейшему улучшению организации общества, усовершенствованию руководства и планирования народного хозяйства.

Усовершенствование методов планирования, экономической информационной системы, снабжения и сбыта, хозяйства промышленных предприятий, финансово-банковской системы и работ по проектированию и исследованию требуют развития техники расчета и прогрессивного создания национальной системы обработки данных. Поэтому, исследования в области экономики в будущем будут базироваться в особенности на применении методов планирования, руководства и организации экономических процессов, основанных на современных средствах расчета данных. А также, будут расширены исследования в области экономической кибернетики и экономической информации, руководства предприятиями. Одновременно будет разработана программа научных исследований национального значения, включая и программу расширения применения математических методов и операционных исследований в народном хозяйстве.

Центр Экономического Расчета и Экономической Кибернетики направляет свою деятельность на разработку техники кибернетических моделей, на применение методов операционного исследования в экономике и систем программирования и числового расчета.