C. BÎLCIU
V. BÎȚĂ
R. HOMESCU
Department of Economic Cybernetics
Academy of Economic Studies

The Research Laboratories in the Process of Education

"We must improve the system of teaching laying stress, as it happens on a world plane, on laboratory activity and on practice".

Nicolae Ceaușescu

Being a component part of the Economic Cybernetics Department, the research laboratories were set up in 1963, as a result of the necessity of interposing scientific research — as an important linking factor — between the didactic process and that of concrete economic activity-production. Setting out from the major requirements of our economy materialized in the extension and improvement of the technical-material basis of the country, the building of our manysidedly developed society, the training of specialists for production become a major condition for ensuring the qualitative and quantitative increase of goods. Economic higher education and within it, education in the field of economic cybernetics represents one of the main links ensuring the training of highly skilled specialists. To attain this desideratum, education must ensure, at the highest level, the conveying of solid knowledge deriving from the concrete economic life, from the realities of production and be able to arm with a high capacity of using the most modern specific methods for the best solving of the economic processes and phenomena. For this reason, the research laboratories play an essential part in the education of students, future specialists. On the basis of priority criteria, they select themes of scientific research on concrete economic processes of major interest, deriving from the present and future necessities of the nationl economy, at the same time, representing a casuistry in the educational process.

Already on the setting up of the research laboratories of the Economic Cybernetics Department in 1963, the closer blending of the instructive-educa-

tive process, of scientific research and material production was pursued. The problems of study have been selected from the productive units with which the Department had conventions of collaboration and used as a didactic material in education. Researchers belong to the teaching staff, either within courses or as part of practical works or seminars.

The first steps in scientific research were made with the setting up of the department (1949), when the relatively small group of professors existing at that time, laid through efforts inherent in any beginning, the foundations of the present-day research laboratories, by purchasing through their own efforts office computing machines meant to replace routin work and to solve the problems of economic and statistic calculus. Already at that time, the Economic Cybernetics Department proposed itself as an objective of large scope the improvement and modernization of the methods of management, planning and organization of economic activity based on the introduction, on the one hand, of analytic quantitative methods, of the instrument of mathematical investigation and, on the other hand, of the modern data processing techniques and means, for a rigurously scientific substantiation of the complex decision making process in the economic field.

Concurrantly with the precise project of research and turning to account of the results obtained in production, the objective with a large scope and particular importance facing the department was the training of students with these modern computing methods, techniques and means within the educational process.

Being permanently and highly concerned with putting education on modern bases, the department leadership made remarkable efforts to endow the laboratories with most modern data collecting and processing equipment necessary for education. This has created the possibility for the entireeducation to be more organically linked with the needs of the economy, to ensure the acquiring of the latest computing techniques (mechanized, mechanographic and automated), graduates acquiring the knowledge and facility necessary for the approach and solving, on modern basis, of the essential economic problems.

In 1965, the department laboratories enriched the modest number of equipment with bookkeeping and invoicing machines, completing the existent stock of mechanographic equipment with punched cards. To promote modern computing methods and to endow education with automated data processing equipment, in 1966, the department installed the Romanian "ECONOMIST-CIFA 102" computer. Together with the researchers and the teaching staff, students learnt on this equipment the programming of various economic problems. It was out of the necessity of acquiring programming and the computing techniques for the students to solve the economic-mathematical models and the algorithms implied in the economic problems that the second electronic computer of the laboratories was purchased in 1968, of Japanese make, NEAC-1240, with a punched tape as a technical information support. It should be mentioned that this electronic data processing equipment serves education, in good conditions, also today. Another series of electromechanic or electronic computing, bookkeeping and invoicing equipment, data collecting and processing equipment, simple computing or programming electronic machines, as well as the electronic mini-computers manufactured in

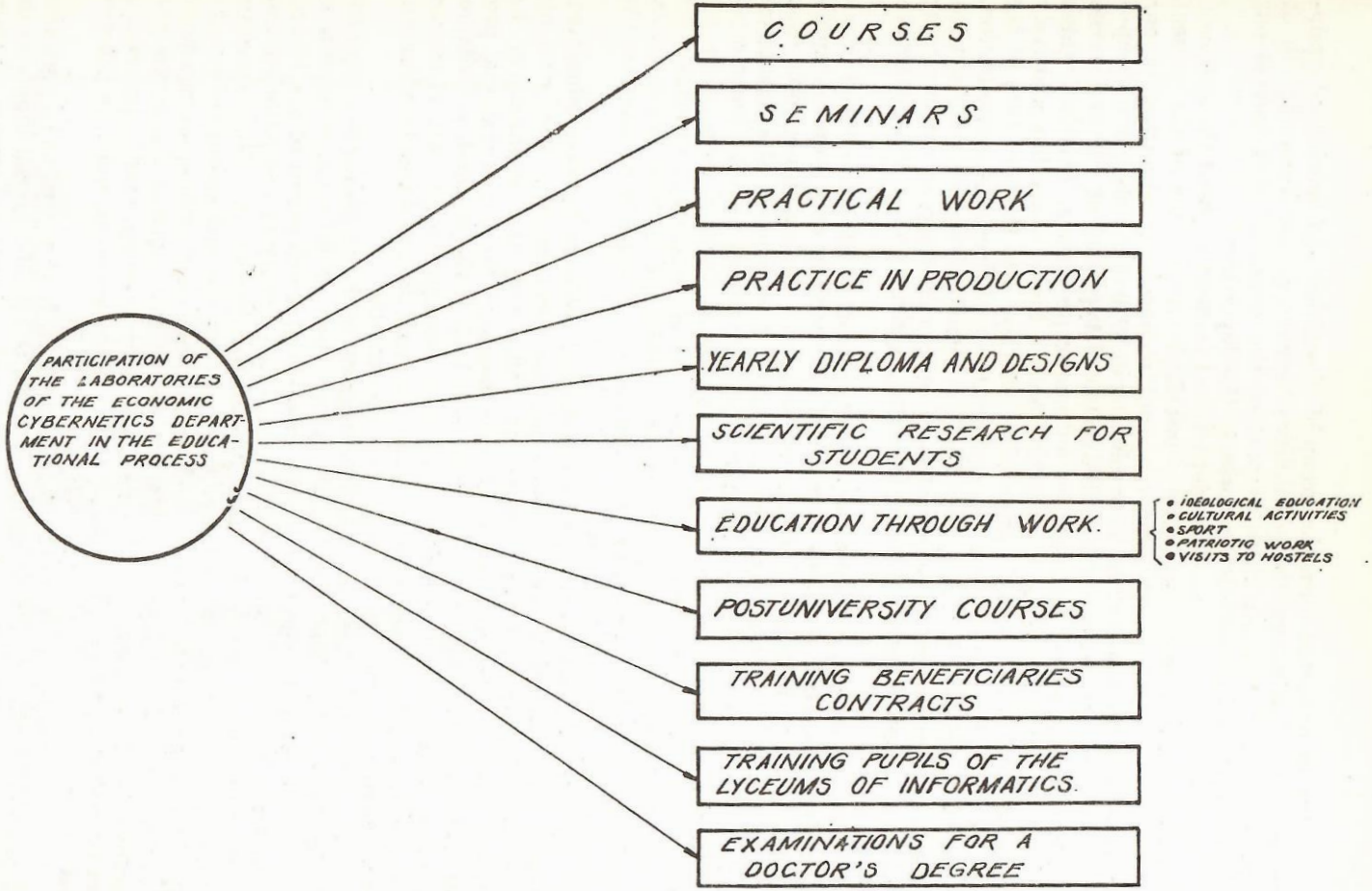
PARTICIPATION OF THE LABORATORIES OF THE ECONOMIC CYBERNETICS DEPARTMENT IN THE EDUCATIONAL PROCESS
COURSES
SEMINARS
PRACTICAL WORK
PRACTICE IN PRODUCTION
YEARLY DIPLOMA AND DESIGNS
SCIENTIFIC RESEARCH FOR STUDENTS
EDUCATION THROUGH WORK.
• IDEOLOGICAL EDUCATION
• CULTURAL ACTIVITIES
• SPORT
• PATRIOTIC WORK
• VISITS TO HOSTELS
POSTUNIVERSITY COURSES
TRAINING BENEFICIARIES CONTRACTS
TRAINING PUPILS OF THE LYCEUMS OF INFORMATICS.
EXAMINATIONS FOR A DOCTOR'S DEGREE

Fig. 1

the country or imported form the group of diversified and specialized equipment, students thus having the possibility of enriching their knowledge about programming and of using them as part of the practical work carried out in the research and didactic laboratories of the department.

The permanent concern of the department leadership about the adequate equipment of the research laboratory inscribed on the line of the present and future requirements of improving and modernizing education in our country — was materialized in the purchasing in 1970 of the electronic computer of the third generation, of the IBM 360/40 F type and of the peripherial equipment for preparing the data for automatic processing. This fact which is important for the passing of education onto a higher stage has positively influenced besides the research-production activity also the structure of the curricula of the Faculty of Economic Cybernetics and Economic Computation. It is worth mentioning in this connection the introduction into the curricula of the followings courses: Fundamentals of electronic computer construction; Electronic computer programming; Operating systems; Applicative programmes, etc.

Scientific researchers have worked out, as part of the laboratories, courses for these subjects, collections of exercises and problems with economic applications, booklets, folders and electronic computer programming, operating and use-guides, etc. Moreover, we have put at the disposal of students, as part of specialized libraries — organized and developed by the department laboratories — text-books and guides on the use of electronic computers, reference materials on the scientific programmes of computers, directions for the use of various experimental programmes, books and reviews of especiality as well as informatic system projects drawn up by reserchers based on the themes of the economic contracts.

In this way, besides the symbiosis which is achieved between education, research and production, the contribution of the laboratories of the Economic Cybernetics Department was important from very the beginning of its activity. Both the technical-material basis necessary for the educational process and the didactic activity and combined with it the research activity on the basis of contracts which serves education through the selection of themes of major interest for the economy, forming the rich data and casuistry for students, have been ensured through the laboratories.

The year 1974 marks an important moment in the ascending development of education in the field of economic cybernetics and informatics as well as of economic computation, through the substantial development of the technical-material basis materialized in the increasing capacity of computation and the introduction of teleprocessing, of visualizing devices, etc. This important step in the best equipment of the research laboratories will create the possibility of training students for using the latest methods and techniques on a world plane in the field of economic data processing, will acquaint the future graduates with the techniques and methods of teleprocessing, multiprogramming and time-sharing which will be largely used in the economic units, in the nearest future.

Covering stage by stage the development of the department laboratories, we can sum up the aspects connected with the technical-material supply in the fact that all conditions have been ensured to the educational process for train-

ing the future specialists of high qualification in the fields of economic cybernetics, economic informatics, economic and statistic computation, the department laboratories possessing a wide range of equipment from the simplest to the most complex ones.

The activity carried on by the students within the department laboratories can be illustrated with figures as to the big number of computer hours-used, the number of programmes and works made on the computer (Fig. 2, table 1) as well as through the number of hours in the preparation of data and programmes.

Table 1

Practical training for students on IBM computer

Academic year	1970/71	1971/72	1972/73	1973/74
No. programmes			7000	10500
No. runs			70000	105000
No. computer hours		1570		
No hours punch /checking of cards	587	1842	7476	8000

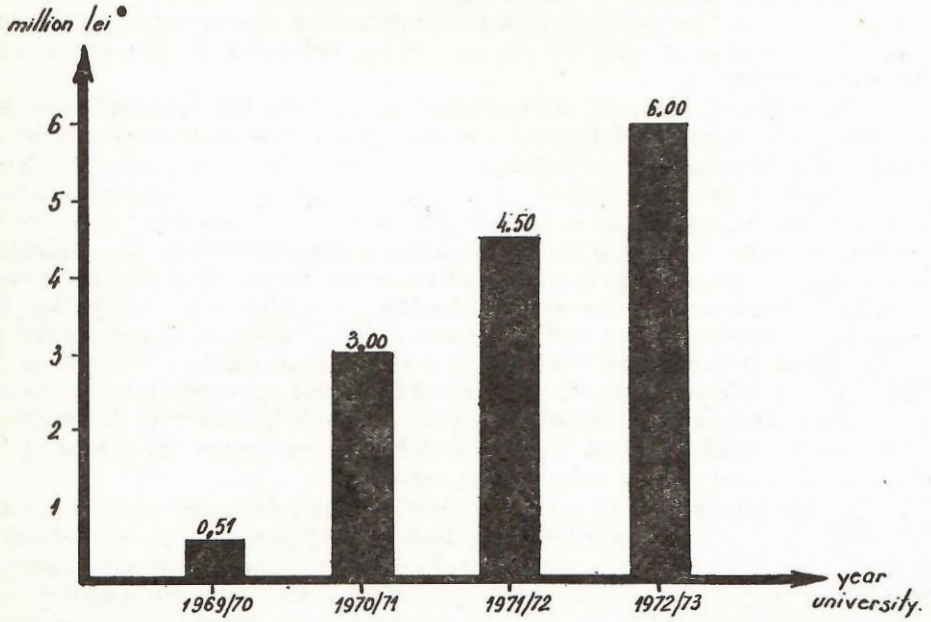

Fig. 2

A rich didactic and scientific research activity has been carried on with the students in the laboratories of the Economic Cybernetics Department. As has been previously underlined, the laboratory research workers have elaborated courses, collections of problems, programming guide-books, etc. and participated in the defending and leading of courses, seminars and practical training (for 15 subjects, on an average, in an academic year). Besides this activity, they sponsored yearly and diploma papers (90 diploma designs in an academic year) which, compulsorily (a condition for promotion) contain solutions to problems pertaining to concrete economic activity. Simultaneously with this important didactic activity, the department laboratories have distinguished themselves by the participation of researchers in guiding practical training in economic units, computation centres and particularly in their own laboratories. It should be pointed out in this connection that the over 200 students (on an average) who did annual practical training, every academic year, within the department laboratories have effectively worked shoulder to shoulder with the reserachers on the scientific research economic contracts. This working method — students by the side of researchers — has proved extremely efficient in the educational process, a fact which was reflected in the very good results obtained, on the one hand, in the diploma designs and later after the employment of the graduates, on their work places on the other hand. Within the didactic activity, besides the courses and seminars upheld by researchers, a real contribution was made to the carrying out, in best conditions, of the important number of practical works (within the laboratories) materialized in solving, with the aid of the data processing equipment and especially of the IBM 360/40 F electronic computer, a number of economic problems as part of the research activity on the basis of contracts. Significant from this point of view is the dynamics of the value of the work made for the didactic process on equipment belonging to the department laboratories (Fig. 3).

The students, guided by the research staff of the laboratories have worked out models and algorithms for various concrete economic problems, intensively using the existing data processing systems. In the 1972/73 academic year, 1600 students have worked on the electronic computer, having run about 70,000 programmes on the computer and having carried out about 70,000 programme runs. (See table 2). Special importance was given to the utilization in the didactic process of the results of the scientific research and production activity carried out by researchers, to the effect that a preoccupation has existed for the compilation and enrichment of the portfolio of cases drawn up on the basis of the solved research themes. Significant, for example, is the 1972/73 academic year, when 7 studies and collections of cases (totalling nearly 1000 pages) and on the basis of the solved research themes over 30 syntheses and reports (totalling about 3500 pages) have been drawn up, placed at the disposal of students as a reference material.

An important part in the attraction and stimulation of students in the research activity was played by the leading and guidance by the research workers of student scientific circles and of scientific research papers by students. Significant in this connection is the attraction of students into mixed groups alongside the academic staff and researchers in the solving of the scientific research contracts. During the 1972/73 academic year alone, over 300 students

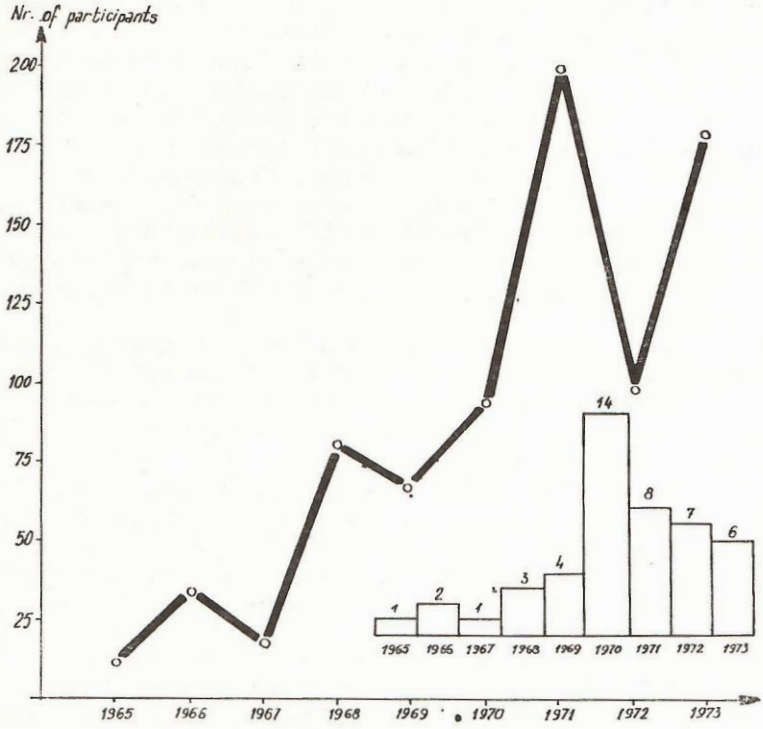

Fig. 3

Table 2

On the use of the electronic computer in the educational process

Year	1970	1971	1972	1973	1974
Number of students of the Academy of Economic Studies using the IBM-360 computer	800	900	1100	1500	2000
Number of computer-hours consumed in the educational process	2500	3500	4100	5000	5500
Number of elaborated programmes	2400	3000	4400	5000	7500
Total number of runs on the computer	26400	36000	52800	70000	84000
Number of punched/checked cards	38500	45000	180000	750000	800000

of the fourth and fifth years carried on a permanent research activity or on the occasion of the practical training for students, for solving the themes stipulated by the contracts within the laboratories. A big number of students with special aptitudes for research work have been temporarily employed (half time) in the laboratories of the Economic Cybernetics Department, bene-

fitting from an adequate pay. This form of attracting the students into research activity proved to be extremely stimulative.

Under the guidance of the academic staff and of the researchers of the department laboratories, the students of the faculty carried on a sustained research activity within the students' scientific circles. There were five scientific circles during the past two academic years: Economic Cybernetics, Operations Research, Electronic Computers and Automatic Computation Systems, Economic and Statistical Computation, Algorithm programming languages, circles as part of which a big number of second, third, fourth and fifth — year students have worked. In the 1972/73 academic year, for example, over 190 students have worked, studying 65 themes in important domains, with implications in the national economy.

Special appreciations on the research activity unfolded by students were made on the occasion of the organization of the 16th session of scientific circles when, as part of the sections organized within the faculty, with the support of laboratories, 46 papers were presented, selected from the themes discussed in the circles, of sure theoretical and applicative value.

It is worth mentioning that 70 of the 344 papers presented at the session of the student scientific circles in the 1972/1973 academic year, belonged to the students of our faculty — representing 25% of the total number of papers of the Academy of Economic Studies. Most of these papers were guided by the research workers of the department laboratories. A big number of papers have been awarded prizes.

The interest manifested by the laboratory research workers in the educational process, by participating actively, consistently and passionately was also manifested in the organization of applicative work with the students in various industrial enterprises and research units (the Factory for computers, the Research Institute for the Light Industry, the "Danubiana" Rubber Works, the Central Board of Statistics, etc.) as part of the courses and laboratory work for the subjects: Electronic computers, the analysis and design of economic informatic systems, etc. Fruitful results have also been obtained, in the direction of linking the educational process with economic practice, in the subjects as part of which applicative work has been unfolded in the department laboratories, especially in the programming of electronic computers, applicative programmes, computation equipment, etc.

The sustained work of attracting students into the scientific research activity carried on within the laboratories was also materialized in the participation of the students in the scientific seminars organized in the research sections of the laboratories: the seminar of economic-social prognosis, the seminar of operations research with applications in the economy and the seminar of informatic systems with applications in the economy. On this occasion, students come in contact with and participate in the debates on the theoretical and applicative results obtained in the examination of extremely important themes deriving from the present requirements of economic-social development.

Taking place at a high scientific level, the debates help students in having their own opinions about the ampleness and profoundness of the theoretical and practical problems — which is important and instructive for their formation as future specialists. The debates also enable them to consolidate the

knowledge acquired on the themes under discussion, problems on modelling the economic growth, modern methods used in prognosis and planning, integrated systems of the efficient programming of production, informatic systems of technical-material supply, applications of mathematics in economic modelling etc. Moreover, students acquire solid additional knowledge with the aid of which they complete the theoretical and applicative information acquired during the courses, seminars and practical works.

The special attention granted by the laboratory researchers to the educational process is also reflected in the extremely big number of consultation hours for the students (3500—4000 hours annually). These consultation hours are taking place either within the laboratories or within the courses and seminars. Students have the possibility of asking for daily consultations in the period of the exam sessions, on statutory holidays inclusively, being able to apply unrestrainedly to any scientific researcher for support. In the period prior to and during the exam session, consultations are organized minutely, due on the one hand to their solicitation by a big number of students and, on the other hand, due to the differentiated character of the consultation hours on subjects, types of problems, etc.

It is worth mentioning that the laboratories of the Economic Cybernetics Department, all researchers without exception, grant consultation hours, a fact which is also explained by the big number of hours which are given annually.

The promotion of the modern methods used in education is holding a leading place within the laboratories. Through the presentation of the courses, seminars or practical works with the aid of projection apparatuses (retroprojectors, epidiascopes, diascopes), through the use of programmed education, of course aids, multiplied diagrams, panels, clay models, sketches and through the use of microexhibitions — the monotony characteristic of the old teaching methods being removed — a modern conduct is ensured to the educational process, which makes students to abandon the outmoded practice of mechanically taking notes. The Department laboratories have also initiaded the action of multiplying the bibliographical notes at the courses and practical works and the inventory of all existing teaching aids necessary in the documentary activity and individual study of students.

Another important activity emphasizing the preoccupations and contribution of the department laboratories in the educational process is that of the specialization of the staff in the economy through various forms of education: the teaching within laboratories of programming, economic cybernetics, operations research etc. for specialists and collaborators of the research contracts, through lectures held in various enterprises throughont the country and through the afore-mentioned post-graduate courses.

The dynamics of the specialization courses for the staff in the economy organized within the laboratories of the Economic Cybernetics Department and of the number of participants is presented in Fig. 4.

Simultaneously with the holding of these courses for the staff employed in the economy, the department laboratories organized already in1970 training courses in the programming of electronic computers for the pupils of the lyceums with classes of informatics (the "Mihail Sadoveanu" lyceum), totalling 50 trained pupils at the end of the 1973/1974 school year.

An efficient preoccupation which has faced and continues to face the research laboratories was the participation in recruiting the candidates for admittance to the Faculty of Economic Cybernetics. The action took place both at the lyceums in Bucharest and at those in the towns in which the department had contract relations with the economic units.

An extremely important direction inscribed on the line of professional training is the examination for a doctor's degree — an integral part of the educational process of the staff with higher training. In this connection, apart from the big number of researchers, candidates for a doctor's degree, an important number of teching staff, both within the department and other departments of the Academy of Economic Studies are carrying on their activity as candidates for a doctor's degree, having at their disposal reference materials, electronic computer-hours as well as consultations of speciality. At the same time, part of the candidates for a doctor's degree working within the department or other departments have the possibility to work within the research contracts of the laboratories-this being of real use to them in establishing the theoretical conclusions of the paper on the basis of concrete economic activity.

Besides the examination for a doctor's degree — as a means of training our own staff—the research laboratories have also used other forms of education such as: the participation in post-university courses, intensive courses (summer schools, courses organized by other institutions, etc.) as well as specialization in the country and abroad or exchanges of experience and scientific documentation.

A characteristic which is worth mentioning, which fully observes the requirements facing all higher educational institutes and their laboratories is that of covering the due expenses, through a collective research activity. In this connection, we point out that the research laboratories of the Economic Cybernetics Department, through their sustained activity have succeeded in financing themselves, having covered besides other expenses also the necessary expenses for carrying on the educational process in the field of economic cybernetics, economic informatics, economic and statistical computation.

All conditions have thus been created for the further developemnt of modern research and education, ensuring by — self-endowment-the necessary material basis. It should be pointed out once more that the results obtained so far by the department research laboratories in the educational process are sure premises which are worth developing in the future for providing our national economy with highly skilled specialits, capable of running the immensity of economic processes and phenomena characteristic of a dynamic, ever more powerful economy.

The so far achievements of the laboratories of the Economic Cybernetics Department in the development of modern education oblige researchers to continue their efforts, ever more harmoniously and ever closer blending the sides of education-research-production triangle.