JPRS L/10658

15 July 1982

USSR Report

SCIENCE AND TECHNOLOGY POLICY

(FOUO 3/82)

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APPROVED FOR RELEASE: 2007/02/09: CIA-RDP82-00850R000500080032-3

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FINANCING S&T PROGRAMS

Moscow VOPROSY EKONOMIKI in Russian No 3, Mar 82 pp 13-22

[Article by P. Sedlov and T. Sletova: "Financing Scientific and Technical Programs"]

[Text] Scientific and technical programs are a specific form of intersector planning and control of scientific and technical progress. They are formulated for the resolution of such complicated problems which require the involvement of a large number of scientific organizations and enterprises of various sectors, the concentration of scientific forces, material and financial resources.

The creation of effective systems for controlling programs was acknowledged by the 26th CPSU Congress as one of the primary tasks. The systems for controlling them should be organically entered into the economic mechanism. The complexity of solving this problem is that on the one hand, it is necessary to strengthen the centralized basis for solving the intersector and interregional problems in order to concentrate resources on solving the most important of them, and on the other hand, broader development of cost accounting. The economic mechanism for controlling intersector programs can be effective if it stipulates equal economic conditions for all links which are participating in the implementation of the "science-production-application" cycle.

The system of controlling scientific and technical progress and its component, the financing system, still do not permit complete realization of the advantages of the program-target method since they are primarily oriented on the sector principle of control. Planning and control are organically separated into different stages of a unified scientific-production cycle which is encompassed by comprehensive programs. In particular, the GKNT [State Committee for Science and Technology] coordinates the NIOKR [scientific research and experimental design work] and plans financial resources for the fulfillment of this work by programs. Planning of the production stage which is associated with the development and introduction of new equipment, including the preparation and development of production facilities, is the function of the USSR Gosplan.

Rapid control of scientific and technical programs has been decentralized. The main ministries and organizations which are responsible for the fulfillment of the program as a whole, practically do not have levers for influencing the co-executors beyond the limits of their sector. They do not have authority, do not have a control apparatus for solving questions of financing and material-technical support for the entire set of interdependent sectors and industries covered by the programs. Consequently, the chief ministry is not capable of overcoming the disagreements which go beyond the framework of sector planning, financing, and material and technical support by using their own forces. All the interdepartmental disagreements are placed at the level of the USSR Gosplan and the GKNT which overloads their resolution of these questions. They could be and should be solved rapidly at the level of program supervision.

The experience of realizing integrated scientific and technical programs, sector, intersector and regional in the 9th and 10th Five-Year Plans indicated their profitability. Among the 208 intersector scientific and technical programs developed under the supervision of the GKNT, a number of programs have been successfully fulfilled for the development of the country's fuel and energy base which stipulated the creation and development of series production of units of increased unit output, production of compact engines with power of 8,000-10,000 hp, more advanced energy consuming equipment and technology, accelerated development of atomic machine construction, etc. As a result of fulfilling these programs, the indicators for conservation of consumed resources and the quality characteristics of the created samples were considerably improved as compared to the base. For example, the metal consumption of boiler units created from one of them was reduced by 40%, the periods for installing the equipment were cut in half, the capital outlays were decreased by 30%, etc.

Work has been intensive on the program of creating and using in production automatic manipulators with program control (robots). The Kovrovskiy mechanical plant was the first to broadly introduce industrial robots. Now robots are operating there of the models "Tsiklon-3B," "Universal-15M," "Universal-5" in the stamping, machining and other industries. As a result of their use, labor productivity rose an average of 3-fold, and at individual operations using robots, 5-6-fold. The labor intensity of processing the parts diminished on the average by 43%.

The development of a number of programs indicates the successful cooperation of academic science and production. For example, in order to solve tasks of intensive development of the economy of Siberia, the Siberian department of the USSR Academy of Sciences in cooperation with the sector institutes and production is realizing a long-term integrated program "Siberia" which includes 35 target programs to investigate and use the fuel and energy and mineral-raw material resources, develop the territorial-production complexes, and create the equipment and technology with regard for the climate conditions of application. The Ural scientific center of the USSR Academy of Sciences heads up the long-term target integrated program "Intensification of Industrial Production of the Urals." The implementation in the Latvian SSR of a regional integrated program for mechanizing manual and heavy labor in industry, in transportation and in other sectors made it possible to conditionally release about 16,000 workers engaged in manual labor. According to the scientific and technical programs developed in the 10th Five-Year Plan, about 1900 new types of machines, equipment and instruments, and over 1000 advanced production processes were made. Analysis of the realization of some of them made it possible to reveal a number of shortcomings and difficulties governed both by economic and organizational reasons. We will examine them in the example of one of these programs.

According to the integrated program for the creation of automated control systems for production processes, units and industries headed by the Ministry of Instrument Making , 292 types of new electronic computers, devices and instruments were developed and introduced into production. For the development and organization of series production of sets of technical and program resources SM3, SM4 of the international system of small computers (SM EVM), the collective of developers of the program was awarded the State Prize for science and technology in 1981. About half of the complexes obtained by the national economy have been supplied to the machine construction sectors for control of production processes, automation of design operations and control of the complexes of metal-working equipment; 22% in the sector of the extracting and processing industry for control of production processes; 14% of the complexes are being used for control of experiments in the sphere of science. The use of SM3 and SM4 complexes for automation of the planning of new items permitted a 2-2.5-fold acceleration of this labor-intensive process.

A large economic effect is yielded by the use of the system of small computers in the preparation of controlling programs for machines with numerical program control. These programs were previously prepared on large computers whose cost is considerably higher than the small computer system. The transition to the system of small computers reduced the periods for compiling the controlling programs several times and significantly diminished the outlays for their development.

However the scales of production of small computer systems does not meet the national economy's demand for them. What is preventing the rapid increase in volumes of production of minicomputers? The fulfillment of the aforementioned program, like others, was associated with a number of difficulties due to various reasons, including departmental barriers, incomplete order for financing and material-technical supply. The Ministry of Instrument Making which is responsible for the program as a whole did not always succeed in concluding a contract in time with the co-executors for including in their plans of individual assignments of the program and the allocation of the appropriate resources. Great efforts were required to arrange the orders for development and series production of the developed models at the enterprises and production associations which specialize in the production of computer equipment. The chief developer could not, by by-passing the sector sections of the USSR Gosplan, correct the plans of loading the production facilities of the manufacturers so that production was guaranteed of the programmed product in the schedules set in the approval of the program. The course of its fulfillment was also affected by the circumstance that neither the financial support, nor the material incentive of the executors took into consideration the features of program and interdepartmental interaction.

In total complexity, about 40 percent of the work to create and introduce experimental and experimental-industrial samples stipulated by the scientific and technical programs of the GKNT was removed or transferred to other periods because the assignments of the programs for construction, installation and shipments of set-forming items and equipment were not always agreed upon by periods, or were not included in the sector plans for capital construction, production and material-technical supply of the corresponding executors. For example, the program for creation of chemical resources for the protection of plants stipulated the start-up of eight industries at the enterprises of the Ministry of Chemical Machine Construction. Because of the untimely financing or insufficient volumes of it, the lack of a specific organization that was responsible for the start-up of the facilities, and for other reasons, the periods for the start-up of three industries was shifted to 1979 and 1980, and the others to the 11th Five-Year Plan.

The order for financing work for new equipment that was active in the sectors was used without any changes for financing the scientific and technical programs. Each ministry which participates in the fulfillment of program work used for financing the work stipulated in the program capital which was mainly intended for ensuring the scientific-technical development of the in-house production base of the sector and updating of the manufactured product, as well as for financing work on intersector programs. This order generally does not create interest in rapid and high-quality fulfillment of the intersector work, since the diversion of resources of each ministry (department) for these purposes can contradict the primary interests of sector development.

The order for listing the resources for financing programs and calculation of their spending are also incomplete. The capital allocated for financing work on programs are listed on the calculated account of the organization-executor and are depersonalized in the total sum of income. This impairs the calculation of their target use for program needs. Undercalculation of the specific nature of intersector division of labor, departmental separation of the executors, the large number of sources for financing work for new equipment, and the lack of the necessary correlation between the assignments of the program and the plans for production and capital investments contradicted the requirements of the target control of scientific and technical programs, and essentially became a drag on their broad and effective application.

In evaluating the important role of scientific and technical programs in accelerating scientific and technical progress, it should be noted that they do not completely reflect the requirement of directivity for the achievements of science and technology to final national economic results. In the majority of them, for example, there was no stipulation of assignments for series production and the use of innovations. The programs for the creation of new machines, equipment and instruments generally ended with the fabrication and testing of the main sample or the manufacture of an adjustment series, the first batch of a product with the use of the new technological process. Consequently, at best they stipulated the initial development of the created equipment, but did not plan its broad application.

The question of the need to include completing stages of series production into the scientific and technical programs and the use of new equipment has been raised many times in the economic press.[1] In the last five-year plan, individual elements were worked out for a program-target method of planning

[1] See, for example, Corresponding Member of the USSR Academy of Sciences L. Gatovskiy, "Strengthening the Orientation of Plans and Stimuli at Highly Efficient New Equipment (VOPROSY EKONOMIKI, No 5, 1977); D. Bobryshev, V. Pokrovskiy "Control of Scientific-Technical Development" (VOPROSY EKONOMIKI, No 12, 1977) and others.

and control at intersector and sector levels. The accumulated experience was generalized, and in the decree adopted by the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Intensification of the Effect of the Economic Mechanism on Improving the Efficiency of Production and Quality of Work" measures were stipulated for the development of the system of programs, inclusion in them of assignments for organization of series production of new equipment and introduction of the leading technology.

The inclusion into the target scientific-technical programs of the completing stages of series production of new equipment and the introduction of technology makes it necessary to create an efficient organizational-economic mechanism of control which meets the requirements of intensifying scientific and technical activity and orientation of all the economic links on high final results. It is apparently necessary to raise the status of the agencies of program control and give the main organizations the right to independently eliminate the current intersector discrepancies for each program.

The creation of a mechanism for planned control of intersector programs is impossible without the solution of such an important problem as their financing. The time has come to centralize and regulate the financial planning at higher and middle levels of control.

Financing of scientific-technical programs must, in our opinion, be implemented on an indepenent plan which will distribute and calculate the resources. It is very important that the unified integrated plan define from the very beginning the financial resources for the entire cycle of work covered by the programs, and distributed at the stages of work, for scientific research, experimental design, technical preparation of production, development, etc. This distribution must be supplemented with efficient monitoring and calculation of the target spending of capital. It is also important to eliminate the multiplicity of sources and multiple-stage nature of distribution of finances.

The financing system must be aimed at timely provision of capital to the planned volumes of work and its rapid concentration on the most strained sections. Therefore, financing of work done on intersector scientific-technical programs should be done with regard for the main principles of program-target method, as well as the active statutes on the order for using state budget resources, credit, resources of the unified fund for development of science and technology and other sources of financing work on new equipment at enterprises, associations and organizations.

The founding principles for this system, in our opinion, should be the following. First, the functions of financial control of programs should be centralized on higher and middle levels, and more precisely delimit according to levels of control the responsibility of the managers of financial resources. It is expedient to provide for more active participation of the agencies of the USSR Ministry of Finances in selecting the forms of financing and controlling the financial resources. Secondly, financing of problems, topics and work[1] must be target. Thirdly, there should be guarantee of flexible combination of the percentage financing from resources of the ministries, departments which are interested in the results of the programs,and resources of the state budget and credit allocated for fulfillment of definite work. Fourthly, it is important to regulate the processes of formulating financial plans, establish control and calculation of the spending of resources from the active sources of financing work on the new equipment, having guaranteed in this case the priority of allocating resources for programs from all sources.

The system for financing integrated scientific-technical programs constructed with regard for the stated principles, in our opinion, will permit target and timely financing of the work planned according to the programs, scientific research, experimental design, fabrication of experimental and experimental-industrial samples and units, test stands, development of experimental samples in production, technical preparation of production for series manufacture of products, including work on reconstruction and expansion of production facilities.

The introduction for all ministries and departments participating in financing the corresponding programs on percentage principles, of a unified order for deductions of financial resources and their primary allocation from the corresponding sources will create definite guarantees for the fulfillment of assignments on schedule. In this case it becomes possible in limits of the general limit allocated for the program to distribute beforehand the financial resources according to stages of work, to implement a balanced correlation of financial resources with material-technical supply of the work, rapidly correct the distribution of resources in limits of the estimated cost and use the reserve (if it is stipulated) with regard for actual fulfillment of the work. Finally, expansion of the use of credit, giving the main organizations the right to dispose of the capital allocated for the program (and if necessary to involve enterprises and organizations of different departments in the work on economic contracts) will create an efficient mechanism of control over the programs based on a new progressive system of payment for completely finished work which has been handed over to the customer.

Especial attention should be concentrated on the executive (managing and stimulating) functions of the control agencies for intersector programs. Depending on the scale of work, its spatial and temporal boundaries, various solutions to this problem are possible. In those cases where the functions of rapid control are placed on the main organization, its authority should be expanded for disposing of the capital allocated for the needs of the program and setting up control over the fulfillment of work and stimulation of the groups of executors. For rapid control of large-scale programs, special intersector agencies may be set up. In each specific case it is necessary to regulate the

[1]The use of the system of target or problem planning for orders and the corresponding financing of the sector scientific-technical organizations made it possible to regulate the intraministry thematic planning, and abandon some traditional, but not very promising trends in research and concentrate scientific-technical resources on problems important for the sector and national economy. In addition to accelerated introduction of innovations into production, an important result of this system was the improvement in use of speicalists in scientific and technical organizations.

the economic and legal status of the control agency , determine the nature of its interrelationships with the higher planning agencies, with the linear-staff and funcational subdivisions of the organizations who are participating in the work on the programs.

In order to improve the order for financing scientific and technical programs it is first expedient to formulate an interrelated system of plans for financing them which includes state, sector and financial plans for specific programs. It should be correlated to the entire system of plans, having pinpointed the trends for using the active sources of financing work for new equipment in the sectors and at the enterprises. This does not require a basic review of the rights and functions ofthe apparatus for the sector systems of control of scientific-technical progress and the significant changes in the organization of forms of interaction of several sectors in the realization of integrated programs.

The formation of a system of plans for financing scientific and technical programs is dictated by the expanded use of program-target method for solving the most important and large-scale problems, and increasing the volume of allocations for development of prog"ams. In addition, the spatial and temporal boundaries for realization of the programs rise, there is an increase in the number of co-executors. All of this requires a more precise control and calculation of the allocated resources at all levels of control. In other words, the time has come to strengthen the functions of the centralized planning and control in solving large-scale intersector problems.

The state plan for financing scientific-technical programs should be compiled for the five-year plan based on calculations of the estimated cost of work presented by the main ministries and departments responsible for the fulfillment of specific programs. Its structure can approximately be the following. In the first section of the plan "Volume of Financing Intersector Scientific-Technical Programs by Sectors" it is expedient to reflect the volumes of financial resources allocated for each sector for the fulfillment in the planned five-year plan of work on intersector programs according to the approved list of programs of the state plan for the development of science and technology.

The first section of the plan for financing must indicate the total allocations of the sector for the entire set of fulfilled programs both target and for the resolution of the most important scientific and technical problems regardless of whether the sector is the main or the co-executor. The total must isolate expenditures for scientific research and capital investments needed for the sector's fulfillment of the corresponding assignments for intersector scientific and technical programs.

In the second section, "Trends of Target Financing," it is necessary for each program to isolate the ministries and departments which are responsible for the fulfillment of the main assignments and financing this work, as well as the sources of financing. For each program, the first indicates the main ministry (volume of allocations allocated to it for fulfillment of the assignments of this program, sources of financing the work, state budget, unified fund for scientific and technical work, etc.). Say that for the program of creating automated control systems for production processes, units and productions in industry, the first indicated is the Ministry of Instrument Making and the resources allocated to it for the five-year plan, then the Ministry of the Electronics Industry, Ministry of the Radio Industry and other executors.

It is important for the plan to stipulate allocations for the development and final stages of work associated with mastery and series production of a new product. This order will make it possible to avoid those difficulties that are now encountered by the developers at the stages of production and introduction of innovations where for 1-2 years they have to include the developments in the production plan through sector departments of the USSR Gosplan.

The state plan for financing scientific and technical programs which will become an integrated financial document should determine in advance, according to the active technique, the dimensions of the deductions to the fund for economic stimulation of the enterprises and organizations from the profit obtained from realizing the product, created according to the program, and deductions to the funds for economic stimulation which are included in the estimated cost of work.

It is expedient for the main ministry to be charged with the obligation of controlling the compilation (co-executors) of local estimates for individual stages of work or assignment, summary estimate of outlays for the program, control of the observation of economic discipline by all participants of the financing. In necessary cases (with regard for the actual fulfillment of the work), the main ministry can make its suggestions for the change in schedules and volumes of financing, as well as material incentive for the collective-exectors for examination of the ministries (departments)-coexecutors. If discrepancies develop for the suggestions made, then the main ministry can appeal to the higher agencies the GKNT and USSR Gosplan. Each ministry(department) which participates in the fulfillment of the work for intersector scientific and technical programs will compile its draft of the five-year plan for financing intersector scientific-technical programs which should be formulated in the directed periods.

At the first stage of creating the financial mechanism for scientific and technical programs it is important to precisely define the sources of financing in the functional section depending on the nature of the work done and to make them stable for the entire period required for full completion of the appropriate stage or type of work. This measure is especially necessary in those cases where the periods for fulfillment of the work, especially, the concluding, exceed a year.

The programs of the 11th Five-Year Plan stipulate as concluding the work for series production of new equipment and the introduction of progressive technology. This means that the set of program measures must include the technical preparation of production, expansion, reconstruction of shops and sections, sometimes new construction, etc. Expansion of the spectrum for program work also increases the number of sources for their financing, defined by the active statutes on financing work for new equipment in the sectors. In particular, the amortization deductions, funds for development of production and their reserves, and credit should be used for financing the programs more actively and more purposefully.

For organizations which have been switched to a system of payment for completely finished and accepted work, an important source of financing scientific research in addition to the unified fund for scientific and technical work is the bank credits. The decree of the CPSU Central Committee and the USSR Council of Ministers for improving the economic mechanism has set up favorable conditions for expanding the use of the credit-calculation mechanism. The current outlays of organizations up to the full period of completing the work are covered by means of bank credit in limits of the resources freed up by the customer. In addition, the USSR Gosbank presents to the ministries and departments loans for scientific research on programs in the case of non-correspondence during the year of income into the unified fund for scientific and technical work (YeFRNT) and the sizes of outlays from it.

The associations and enterprises of the USSR Gosbank can issue loans for payment of work financed through the resources of the YeFRNT) if it is done in shorter periods than outlined by the plan, as well as the implementation of highly effective measures for new equipment not stipulated by the plan (on the condition that credit and precentages have been liquidated in the space of 2 years from the day of issue through YeFRNT resources).

Expansion of the sphere of credit for work on the new equipment will make it possible, in our opinion, first of all to realize the principles for target financing of planning and organize economically harmonious activity of the main organization and the organization-co-executors working on a unified order and credit-financial plan; secondly, guarantee in practice equal economic conditions and responsibility of the developers and customers for the new equipment.

Formation of an interrelated system of integrated plans for financing intersector scientific and technical programs with indication of the resources allocated to each sector for specific target programs and for definite types of work for them will considerably improve the order of planning the financial resources at all levels of control of the national economy. In this case, the program section will be isolated in the state budget and in the credit plan in the areas of science and scientific services, capital construction and production. This will considerably improve the system of control and calculation of the target outlays and the effect from the scientific and technical programs.

The proposed centralization of planning financial resources on the state and sector levels, of course, does not solve all the questions of overcoming the departmental barriers in realizing programs and reducing the number of financing sources. It must be supplemented with another series of measures. The system of financing intersector programs can become more efficient if, first, the allocated resources are concentrated in the hands of the agency which is responsible for scientific and technical policy in the country, and secondly, the levels of responsibility of the managers of the financial resources are clearly defined and the rights of the main organization are expanded.

Centralized resources for financing intersector scientific-technical programs should be set up on two levels: on the upper level of control, an intersector unified fund can be set up to provide for scientific and technical programs (MYeFONTP), and on the lower, financial resources allocated from the MYeFONTP to the main organization. It is expedient to form this fund in each planned five-year plan from the resources of the state budget, capital investments and credits of the State Bank and the Construction Bank, YeFRNT, funds for development of production and their reserves, amortization deductions and their reserves, deductions from the net cost of products and other sources of the participants in fulfillment of the programs for the corresponding enlarged standards.

The manager of the MYeFONTP, in our opinion, could be the GKNT which implements centralized planning, control and calculation of the spending of resources allocated by the state for scientific and technical programs. It is expedient for each program to open up a special account with the number of the program in the institutions of the USSR Gosbank and the USSR Construction Bank, and to transfer to it the resources from the MYeFONTP according to the proposed approach to financing the intersector programs.

The main organization should be given the right to dispose of the resources transferred to the special account of the program, and its responsibility should be increased for observance of the financial discipline, compilation and spending of the estimates, calculations with the co-executors of the fulfilled work, and payment of credit, that is, make this organization the main manager of resources from the special program account. It should also be given the right to redistribute the financial resources in limits of the approved estimate between the executors with regard for the actual course of work regardless of their interdepartmental subordination, as well as the volumes and periods for income of resources deducted by the ministries and departments for the MYeFONTP for the corresponding types of work.

It is important for all the ministries and departments involved in fulfilling the integrated programs to establish a unified order for deducting the resources to the MYeFONTP from the active sources of financing work for new equipment with regard for their target purpose according to the corresponding plan.

It is expedient to set up in the MYeFONTP a centralized strategic reserve of resources and to use it for financing the previously unforeseen work, as well as for maneuvering the resources in order to guarantee the assigned rates of work done by different sectors and departments. This reserve can be used even for target stimulation of the results which considerably exceed the planned, etc. The creation of reserves of financial resources can become an important condition for improving the efficienty of control of scientific-technical programs, the timely bringing of innovations to practical application. These reserves are especially necessary in developing programs for new trends in the development of science and technology which are at the junction of different sciences and are based on discoveries, inventions which can be widely used in different sectors of the national economy.

After approval of the estimated cost of the program, the main ministry compiles an expanded financial plan of the program which indicates for all stages, assignments and work the responsible executors and co-executors, volumes of financing, periods for the beginning and end. The financial resources allocated for the fulfillment of program assignments should then be included as a separate line with indicate of the numbers of the program and the model stages of work in the budget and credit plans, the plans for financing scientific research and experimental design work, capital investments and capital construction of the main sector and the remaining executors, say for the program for creating a small computer system, in the plans of the Ministry of the Electronics Industry, Ministry of the Radio Industry, etc.

The estimated cost of the work for the program should stipulate an operational reserve for financial resources. It can be used to cover the gaps in financing planned work and those measures which it became necessary to fulfill after the approval of the financing plan, for accelerating work at the most strained sections, since an important element of program control is that acceleration of work associated with a unified technological chain which guarantees the most effective achievement of namely the final result of the program. The right to manage this reserve should be given to the main organization which is responsible for the fulfillment of the entire program.

The expediency of forming an operational reserve should be determined by the main developer in the preparation of the draft of the scientific and technical program with regard for its scales and complexity, degree of technical preparedness of the problem, technical level of production facilities and other technical and organizational factors. Analysis of the estimated cost of a number of scientific and technical programs indicates that the size of the operational reserve can be established on the level of 6-8% of the cost of the program.

Scientific-technical programs of two types have been outlined for the 11th Five-Year Plan, target integrated and programs for the solution of important scientific-technical problems, a total of 170 programs, of them 41 are target scientific-technical programs to improve the technical-economic level of production based on mass production and the introduction of new, as well as previously developed highly efficient equipment. It is recommended that the target programs, in addition to the assignments for the creation and development of innovations, according to the new method instructions for the development of state plans, include measures for the technical preparation of production for industrial development, expansion and reconstruction of the active industries, and for the introduction of new facilities.

The list of these programs which cover individual trends in technical development of the sectors was defined in the formulation of the integrated program for scientific and technical progress for 20 years. In the selection and development of target programs, in a number of cases their continuity with the programs of the 10th Five-Year Plan was observed. For example, in machine construction this continuity is traced in the development of a target program for the creation and production of technical resources for mechanization and automation of the lifting-transport, loading-unloading and warehouse operations in industry, agriculture, construction and transportation.

With the development of intersector programs for the resolution of the most important scientific-technical programs, it becomes possible to organically combine planning of the development of science and technology, production and capital construction. Apparently, further development of the methodology of program-target planning should occur in a direction so that integrated scientific-gechnical programs become the real basis for the formation of plans for the technical development of sectors, accelerated updating of the production apparatus on a leading technical base, observation of the conservation regime in all spheres of scientific-technical and production activity. Centralization of the functions of financial planning of scientific-technical programs and control of the target consumption of resources, creation of reserves, etc. will promote this to a considerable measure.

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CSO: 1814/71

EFFECTIVENESS OF S&T PROGRAMS REFLECTED IN ECONOMY

Moscow VOPROSY EKONOMIKI in Russian No 4, Apr 82 pp 36-46

[Article by V. Fel'zenbaum, E. Yefimova, and V. Farbirovich: "The Effectiveness of Science and Technology Programs"]

[Text] The 26th CPSU Congress pointed out the need to develop and carry through target programs to solve the key scientific-technical problems. During the 11th Five-Year Plan they are to be used to develop 4,000 types of new equipment and new technological processes. Enormous resources are being appropriated for carrying out scientific-technical programs.[1] Needless to say, the society is concerned with how effectively the capital allocated is used and what contribution implementation of the programs will make to the country's economic potential. Unfortunately, neither planning agencies nor economic science can give a reliable answer to this question because a methodology for determining the effectiveness of the programs has not been developed.[2]

The term scientific-technical program refers to a system of scientific-technical, production, organizational-economic, and social measures directed to resolving certain scientific-technical problems. They result from the occurrence of a gap between the level of the material-technical base of labor in a particular sphere of activity and the level dictated by the needs of the national economy. Various elements of the national economy are joined together in the program to solve these problems. The program is completely or partially (within the limits of the planning horizon) subject to inclusion in the future plan of economic and social development. The moment that the program is included in the plan and the way in which it is included are very important for its realization.[3] In principle they do not change the approach to determining the effectiveness of the program, even though they do give rise to one more aspect of this problem, the need to work out plan indicators for effectiveness.

The uniqueness of the target program method of planning scientific-technical progress is that the object of planning is not a unitary measure assigned to a definite element of the national economy, but rather the scientific-technical problem as a whole. Unitary measure here means concrete assignments for conducting scientific research, development, and incorporation of new technological processes and means and objects of labor. Such assignments are planned separately as part of plans for the development of science and technology which were worked out by appropriate economic elements.

From the standpoint of the systems approach the scientific-technical program is a large system with several distinctive features: purposefulness and controllability; complex multilevel structures; integration; complexity of "behavior" and large dimensionality.[4] For example, the target scientific-technical program to develop progressive technology and industrial methods of construction which provides this sector with a reduction of 25 percent in labor-intensiveness and 10 percent in materials-intensiveness has 2,936 subgoals, assignments, and measures arranged at six levels of the "program tree." There are 651 performing parties taking part in it, including 216 pure and applied scientific research institutes, 135 planning-design organizations, 75 comprehensive planning-research institutes, and 225 science-production and production associations, enterprises, and construction sites.

First of all we must establish what the term effectiveness of a scientific-technical program means. In practice and theory the concepts of the effectiveness of scientific-technical programs and the effectiveness of new technology are often equated, which is incorrect. In the first case we are referring to special planned development work leading to fundamentally new technology, while in the second we are referring to the effectiveness of the new technology itself. This difference makes the program as an object for measurement of effectiveness more complex and gives rise to a number of new, fundamental aspects.

Solving methodological problems of evaluating the effectiveness of programs depends significantly on the content, structure, and nature of the goals of the programs themselves as well as the information available in them. Therefore, the methods of determining their effectiveness must be considered together with the questions of the "technology" of target program planning. For this reason it is useful to consider the structural characteristics of scientific-technical programs beforehand.

When working out methods of determining the effectiveness of scientific-technical programs it is important to consider the practice customary in planning of dividing them into types depending on the final results: programs to solve key scientific-technical problems and comprehensive target programs. The former end with the testing of new technological processes, pilot models of machines, or preliminary batches of new output. The latter contemplate the use of new technological processes and implements and objects of labor on some particular scale and correspond more to the principles of target program planning. Realization of programs of the first type produces a scientific-technical effect (growth in scientific and technical knowledge) and only potentially permits a socioeconomic effect. When programs of the second type are carried out the scientific-technical effect is converted into a socioeconomic effect whose dimensions are determined by the scale of introduction of the particular scientific-technical advance.

When defining the methods of calculating program effectiveness it is important to consider ways of expressing its goals. The goal of a program must be clearly delineated and localized to insure target orientation of the program and successful monitoring of its implementation. The goals and assignments of a program are expressed in definite quantitative indicators ("target norms"). But if the goal of a program is given in the form of a list of general objectives facing the sector (for example, increase production, broaden assortment, and insure comprehensive mechanization and automation of production) and does not contain a quantitative measure, the effectiveness of the program cannot be determined and its performance cannot be monitored. Experience with the development of scientific-technical programs testifies that by no means do they always include target norms. For example, an analysis of 180 of the 208 (87 percent) scientific-technical programs in effect in the 10th Five-Year Plan showed that target norms were reflected in the formulations of the names of only one-third of the programs surveyed.[5]

Equally important for determining program effectiveness is the method adopted for breaking down goals into subgoals, subgoals into assignments, assignments into subassignments and so forth. On the basis of generalizing programs we have singled out two ways of breaking down a goal: technological, in which each subgoal is a sequential step in realization of the goal and assures a contribution to the target result only in its interrelationship with the other subgoals; and subject, in which realization of each subgoal by itself contributes to the results of the program.

An example of the first method of breaking down a goal can be the program to develop and incorporate highly productive varieties of sugar beet with a sugar content of 17.5-18.5 percent. The following subgoals were identified in this program: refining plant breeding methods and development of new seed varieties; refining and introducing a technological process for raising seeds; developing and introducing a technological process and mechanical means for raising sugar beets. It is obvious that if no varietal seeds for such beets are received, it is unnecessary to build equipment to cultivate and harvest them. An example of the second method is a program for the development and production of technical means of mechanizing and automating hoisting-transportation, loading-unloading, and warehouse work. It is broken down into 10 subgoals by types of machinery. In this case realization of even one or two subgoals makes a definite contribution to attainment of the goal, although it will not be completely attained. With the technological method of breaking down the goal it is easier to evaluate effectiveness of the program by the final result, but with the subject method the final results must be added together.

These two principles of breaking down a goal are the main ones, but they do not exhaust the structural description of programs. Analysis of scientific-technical programs which were used in the last five-year plan and contained 1,103 assignments showed that almost every program had both types of breakdowns, but one of them clearly predominated. Overall 85 percent of the goals and 81.3 percent of the assignments were separated out by the subject principle.

What are the guiding methods and indicators to use in determining program effectiveness? According to the Methodological Instructions for development of state plans, the economic effect that will be obtained upon use in the national economy is determined for all types of machinery and technology included in a scientific-technical program.[6] The annual economic effect on volumes of production (application) of the machinery in 1985 and 1990, figured in accordance with the principles of the Methodology (Fundamental Principles) for determining the economic effectiveness of the use of new machinery in the national economy (1977) is used to substantiate the program. This effect is determined for each assignment included in the plan, and then the effects of all the assignments are added together. To reflect the effect of a program in plans at different levels, indicators of growth in profit at the enterprise that manufactures the new machinery and reduction in prime cost of output for the consumer enterprise are used in conformity with the same Methodology. The shortcomings of this methodology are apparent.

In the first place, the indicators of economic (not socioeconomic) effects are often suitable for evaluating scientific-technical programs.

In the second place, adding together the annual economic effect for particular assignments of the program does not answer the question of the effectiveness of reaching the program goal itself, but rather evaluates the "quality" of program writing. Summing up by subgoals identified by the technological principle leads to double counting of the effect. For example, in different blocks of the above-mentioned comprehensive target program for the development of progressive construction technology two functionally interrelated assignments are handled separately: the first is to develop and incorporate production of mechanized electrical tools and finishing machines, while the second is to conduct research and develop new technology processes for finishing work using these tools and machines. According to the Methodology for determining the effectiveness of use of new machinery the effect of both assignments was figured by the use sphere (in construction) and was doubled when they were added together. This same kind of double counting often occurs when the effect is added up by stages of its scientific-technical cycle. This creates the danger that greatly exaggerated figures will be included in the plan for the effect, which may lead to imbalance in corresponding sections of the plan.

In the third place, neither growth in profit nor reduction in the prime cost of output can serve as cost accounting [khozraschet] indicators of the effect at enterprises that are participating in realization of the program. The indicator of growth in profit exaggerates the cost accounting effect for the manufacture of the new machinery because it does not consider real deductions from it: the payment for production capital, fixed payment, and interest on credit. It provides incentive to increase the already enormous enterprise requests for capital investment. The reduction in prime cost of output for the consumer of new machinery is also expressed in growth in profit and, therefore, the indicator of reduction in prime cost has these same shortcomings. The cost accounting effect for both the manufacturer and the consumer of machinery is more reliably reflected through the indicator of net profit (or growth in it).[7]

In view of the specific nature of the object of measurement, the problem of determining the effectiveness of scientific-technical programs, we believe, comprises at least five different tasks:

1. determining the effectiveness of attaining the program goal itself, that is, developing and using fundamentally new machinery in the national economy;

2. determining the effectiveness of the program method of planning attainment of the given goal compared to traditional, nonprogram methods. Formulating this task presupposes an evaluation of what is called the "programability effect";

3. conversion of the indicators of the effectiveness of the scientific-technical program as an integrated system into cost accounting plan indicators of the effect of the individual program performers (scientific research institutes, planning-design bureaus, and enterprises);

4. in the course of compiling the program, determining the contribution of individual subgoals (assignments and subassignments) to realizing the target norm of the program so that the given norm will be obtained as the result of compiling the program;

5. determining the effectiveness (comparative) when choosing alternative ways of achieving the same subgoals, assignments, and subassignments in order to shape an optimal functional structure for the program. Adding the indicators of the effect of such a choice together will answer the question of the quality of program development.

The main task is determining the effectiveness of attaining the program goal itself, that is of solving the particular scientific-technical problem. Other tasks are partial in relation to it. The level of effectiveness of attaining the program goal depends on how socially necessary it is to realize it precisely by a target program, not by traditional planning. The point is that the number of scientific-technical problems awaiting solution significantly exceeds the "capacities" of target program planning. Therefore, the most significant problems, those multifaceted intersectorial problems whose realization demands major structural changes in the national economy and capital investmeny policy, are subject to program development. Determining the programmability effect also permits an assessment of the necessity of a program solution to the particular program.

Realization of the program depends on its inclusion in current and future plans of economic and social development. In this case it becomes necessary to convert the indicators of program effectiveness into traditional indicators of the planned effect of the performers (the third task). The fourth and fifth tasks are related to evaluating the "quality" of program writing. It is recognized that the best model of a program to make control of it easier is the critical path schedule. It is possible to shape an optimal program structure, that is to insure strict correspondence between individual subgoals (assignments and subassignments) to the goal itself expressed as a target norm (the fourth task) and to do this with minimum expenditures (the fifth task) on the basis of an alternative critical path model.

The necessity of determining the socioeconomic effectiveness of programs arises in different stages of the process of developing and realizing them, and each such stage has specific features for calculating effectiveness. We can identify four sequential stages:

1. substantiating the goal of the program for future developers and performers (the target stage);

2. working out a draft of the program, done on assignment from directive agencies by particular departments, scientific research institutes under the direction of a head department (organization), and concluding with adoption of the draft by the directive agency;

3. inclusion of the program in the plan by USSR Gosplan or the state planning committees of the Union republic;

4. realization of the program, involving participation by the scientific research institutes, planning institutes, and enterprises which are the performers of the given program, under the direction of the head department (or organization).

Definite requirements with respect to methods of calculation and indicators of program effectiveness arise in each stage. For the first stage it is most important to resolve the first and second tasks: determining the socioeconomic effectiveness of attaining the program itself and determining the magnitude of the programability effect. In this stage calculations are preliminary in character. In the program development stage almost all the above-listed tasks of determining effectiveness must be accomplished (with the exception of converting indicators to cost accounting plan indicators of effect). The results of the calculations are in the nature of a planned effect. When the program is included in the plan it becomes necessary both to determine the composite (for the entire program) national economic plan indicators of effectiveness (the first task) and to convert them to cost accounting plan indicators for each program performer (the third task). Finally, in the last stage the results of realization of the program (actual effect) must be summarized within the limits of these two tasks.

Let us consider possible methodological approaches to determine the effectiveness of the program goal itself and the program method of planning its achievements as compared to the traditional approach. Because scientific-technical progress is a means of accomplishing society's economic and social objectives, the goals of scientific-technical programs themselves help to attain certain "supergoals," that is, essentially socioeconomic goals. The social consequences of realization of a program are usually more significant than the consequences of a unitary scientific-technical measure. Evaluation of the economic effectiveness of a program only is often inadequate because there must be a transition to indicators of socioeconomic effectiveness. The contribution of a scientific-technical program to realization of society's socioeconomic goals is the final result, and comparing this result to its expenditures characterizes its effectiveness.

The necessity of determining socioeconomic effectiveness is dictated not only by the more marked social orientation of program measures but also by the character of the object of scientific-technical programs. This object and physical result of program realization is usually fundamentally new technology. For example, among the scientific-technical programs that are to be carried out between 1981-1985 using target programs are programs for the development of fast neutron atomic power plants, development and broad use of a set of techniques to increase layer petrolem yield to 55-60 percent, and development of powder metallurgy.

The calculation of program effectiveness can be based on the principles of determining the socioeconomic effectiveness of scientific-technical progress worked out at the Institute of Economics of the USSR Academy of Sciences.[8] The socioeconomic effectiveness of new technology is considered as a composite categroy that encompasses the economic and social aspects of the production and use of technology in their interrelationship. The overall result of the use of new technology is socioeconomic because it consists of two components (economic and social): the increase in production of necessary products (services) and improvement in the conditions of vital human activities.

The socioeconomic effectiveness of new technology is a comparison of its socioeconomic result against expenditures to achieve it. Because the socioeconomic result is the aggregate of various material and nonmaterial benefits to human beings, they are objectively incompatible, like different use values, and cannot be reduced to one benefit. "A comparison of such use values as an apartment, a car, or a trip," Academician T. S. Khachaturov writes, "seems completely impossible at first glance. But in practice they are regularly compared. At the same time, because of inadequate study of the methods of such comparisons and the lack of necessary data, these questions are often answered superficially and mistakenly. We must work out the objective bases for making decisions on the priority of different needs in the interests of socialist society."[9]

A rise in the socioeconomic efficiency of new technology compared to the technology existing today is the socioeconomic effect of the new technology Therefore, just like the result of using the new technology, its socioeconomic effect is a factor, but it contains one additional element: savings of expenditures for the given result. The evaluation of the effectiveness of scientific-technical programs is also conditioned on the time factor. Because of its large scale, realization of a program takes a long time. For example, the scientific-technical programs ratified for the 11th Five-Year Plan are figured for 5-8 years. It we consider here that most of them conclude with production of a pilot model or test run, it is obvious that large-scale introduction of new machinery and technology developed under these programs will go beyond the current five-year plan. For this reason, the savings of expenditures for realization of programs must be determined on a dynamic scale, that is, by a calculation of the cumulative effect for the entire period of operation of the program. The complex problem of adding effects together arises when determining the socioeconomic effectiveness of programs.

In the first place, it is necessary to add together the effect of realization of the program in the sectors that produce and use the new technology. For example, the production and use of metal powders gives a savings of expenditures, eliminates accumulations of metal shavings that are harmful to human health in machine building, and eliminates the noise of metalworking machines, but leads to the production of metallic dust in metallurgy. How can the different results which have social significance be compared?

In the second place, it becomes more important to add together the effects of using technology created under a program in different spheres of social activity and different sectors of material production (for example, the areas of application of laser technology are very broad).

In the third place, it becomes necessary to add together the effects from realization of subgoals or subprograms by the subject principle of breaking down the goal (for example, the effect of different types of machinery under a program for development and production of technical means to mechanize and automate labor-intensive jobs).

The difficulties of adding effects together increase with the conversion of the economic effect of new technology to a socioeconomic effect because the latter is expressed by a vector (an ordered set of numbers), not by a scalar quantity (number). For example, the vector of the socioeconomic effect of new models of tractors designed to replace base models will include the following elements: growth in productivity in hectares of standard plowing; reduction in specific fuel expenditure in grams per horse power; increase in service life in years; savings of expenditures in rubles; and, reductions in frequency of vibration in hertz, noise level in decibels, and concentration of dust in the cabin depending on the content of silicon oxide in milligrams per cubic meter of air, and so on.

The fundamental principles of adding up the socioeconomic effects of different types of technology or the same technology used in different spheres amount to the following. Only the savings of expenditures is qualitatively similar so that the corresponding vector elements can be directly added together. Some vector elements which are formally similar, for example increase in productivity and service life of various machines, cannot be added together because they relate to different use values (these elements can be added together only for one machine used in different spheres). Other vector components with similar names, those which are not directly merged with the use values being produced and whose usefulness (harmfulness) consists in an influence on human beings, can be added together when it is necessary to consider the effects of their interaction with one another.[10]

Given the specific character of the output of a program, fundamentally new technology whose development involves heightened risk and uncertainty, the methods of considering risk and uncertainty in calculating preliminary and projected effectiveness become especially important. Expenditures and results for most programs that envision the development of fundamentally new technology cannot be unambiguously forecast as a definite figure; it is only possible to determine an interval of values within which there is a given probability that they will fall. This was reflected in the fact that the target norms of most of the ratified programs were set in the form of (for example raising the petroleum yield of layers to 55-60 percent, raising sugar content of sugar beets to 17.5-18.5 percent, development and incorporation of open-cut coal mining processes with labor productivity surpassing the present level by 3-4 tons, and so on). In addition, although programs are developed after the completion of pure research, uncertainty in relation to the feasibility of accomplishing the subgoals as such is not eliminated in some of them.

A typical example is the target scientific-technical program for the development and wide use of the set of techniques and technical means for raising the petroleum yield of layers to 55-60 percent. The first subgoal of this program is to develop, refine, and incorporate new methods of physicochemical and thermal influence on petroleum layers. It envisions parallel development of several technological methods of achieving this goal: incorporating technology for use of surface active agents; developing technology for pumping polymer solutions into petroleum layers; developing a technological process for forcing petroleum out with micellar-polymer solutions; and working out the theoretical foundations and conducting a search for microbiological methods of extracting residual petroleum after a layer is flooded, and so on. Although these techniques can be used for different petroleum regions and sectors, for some of them they are alternatives.

Realization of each of these techniques, of course, demands different expenditures whose quantities vary depending on the location and nature of the petroleum-bearing sections. Thus, the problem of selecting the optimal combination of techniques arises. Unlike "subject" and "technological" programs, in these "alternative" programs it arises and is decided not only during formulation of the program but also in the process of its realization. For this type of program, therefore, calculations of effectiveness must be refined constantly during the realization process. The contribution of the particular technique to attaining the goal or subgoal, that is the result of realization of the program, and the expenditures required for this must also be refined. During the process of carrying out an alternative program the probability of attaining the goal (subgoal) for each of the alternative techniques must be evaluated and the program adjusted on the basis of such evaluations. The probability of successful development of a particular technology in the assigned time can be evaluated by experts or by using well-known formalized methods of technological forecasting.[11]

The effect of programability, a concept which has been little developed in the economic literature, deserves special treatment. Determining the programability effect is not a purely academic problem. The fact is that developing scientific-technical programs and building them into plans of economic and social development complicates the "technology" of planning, poses the problem of insuring realization of programs and thus increases social costs for management. For this reason, identifying the programability effect would make it possible, by comparing it with additional expenditures, to establish the effectiveness of applying the target program method of planning to the particular scientific-technical problem. Because the target program method involves the use of the systems approach in planning while the scientific-technical program itself is a "system" the organized interaction of elements of this system produces the specific system effect of program organization.

The occurrence of an additional effect as the result of the interaction of program elements has already been noted in the economic literature.[12] This kind of effect of "system organization" (positive or negative) arises objectively in any system as the result of interaction of its elements. Becoming aware of it and singling it out as a definite variation and part of the overall effect involves development of the systems approach. This type of effect is called the synergetic effect or the effect of system organization.

K. Marx gave the methodological foundations of analyzing the effect of system organization in "Das Kapital." Thus, analyzing cooperation as a form of labor organization in which many people work together in a planned manner and interact with another, Marx wrote the following: "Just as the force of an attack by a cavalry squadron or the force of resistance by an infantry regiment differ significantly from the sum of the forces of attack and resistance which individual cavalry men and infantry men are capable of developing, so also the mechanical sum of the forces of individual workers differs from that social force which develops when many hands participate simultaneously in performance of a single undivided operation, when for example it is necessary to lift a weight, turn a winch, or remove an obstacle from the road. In all these cases the result of the combined labor either could not be achieved at all through individual efforts, could be achieved only over a much longer time, or only on a minute scale."[13]

The fundamental objective of comprehensive target programs as a crucial form of planning is to improve cooperation among different types of activity, phases of the reproduction cycle, regions, and participants in social production. The effect of system organization is a part of the overall socioeconomic effect, measured by the difference between the effect of its functioning as an integrated system and the sum of the effect of the isolated functioning of its elements on the assumption that there is no interaction. In the particular case, if such an assumption has no meaning because the isolated activity of system elements does not produce any useful results, the entire socioeconomic effect of the system is synergetic. Therefore, the programability effect as a manifestation of synergy in planning is part of the socioeconomic effect of attaining the program goal. It is measured by the difference in effects when the goal is realized under the program and when it is done by traditional planning.

But what are the sources of the programability effect? To answer this question we may use the scheme proposed by corresponding member of the USSR Academy of Sciences L. M. Gatovskiy for formulating the "effect of comprehensiveness."[14] According to this scheme, comprehensiveness presupposes, in the first place, a coordinated combination of all the types of technology necessary to realize the final result and, in the second place, a coordinated combination (in the plan) of all participants in the cycle "science — technology — production — consumption" for each type of technology.

Indeed, comprehensiveness is the fundamental trait of scientific-technical programs. But in addition to it the occurrence of the programability effect results from the target orientation. In large part this determines the necessity of bringing together different performers in a program of action. If each of them were to seek its own partners by the trial and error method and set up interaction with them on the basis of cost accounting relations, expenditures of time and capital to attain the goal would increase substantially.

The savings that occurs is also one of the sources of the programability effect, to say nothing of the fact that the programs make it possible to realize goals which isolated performers could not even be aware of and which could not be attained without adopting a centralized decision. Furthermore, joining isolated performers together in a program produces an additional effect because the general and particular optimums do not coincide. An increase in the dimensionality of the system produces an additional optimization effect: the value of the system functional is always less (if expenditures are minimized) or more (if results are maximized) than the corresponding sums of the functionals for isolated optimization of its subsystems.

An equally important characteristic of the program is concentration of the resources necessary to realize it, which is also done on a centralized basis. Therefore, the source of the program effect is not only comprehensiveness but also the target orientation. Both the one and the other are secured by centralizing planning decisions. Therefore, in terms of its organizational-economic essence, the program effect is a centralization effect.[15]

The problem of considering the program effect arises not only for interaction among the measures of a particular program (we will call it intraprogram), but also when different programs interact (interprogram). The program effect as the objective result of interaction during implementation of programs or program measures should not be confused with repeated counting of the effect or undercounting of it as the result of subjective mistakes in the calculation methodology which often occur in adding the effects of particular measures or programs.

Methods for singling out the properly synergetic part of the overall socioeconomic effect of solving scientific-technical problems deserves further study. Methods have not been developed yet for solving this problem in the inverse formulation: adding together the effects of particular program measures and finding the overall socioeconomic effect of a scientific-technical program with the aid of the size of the synergetic component.

It is possible to find the necessary bases to calculate the synergetic effects of many economic systems. For example, if a production association is formed on the basis of several enterprises, the results of its activity can still be compared with the results of the separate functioning of these enterprises. As for management methods, here there is usually no kind of general basis for calculating the effect. Therefore, it is only possible to measure the programability effect if a solution to the particular scientific-technical problem is developed outside the program as a basis within the economic substantiation of the program. This may increase the estimated cost of compiling the program itself, but at the same time it makes it possible to establish the list of program goals in a more profound and substantiated manner, which will pay off ultimately when they are realized.

Methods of modeling programs that make it possible to reduce such additional expenditures to a minimum are now being developed. We are referring to alternative critical path models in which the magnitude of the programability effect is determined directly during the selection of the optimal program alternative.[16]

Alternatives that are not included in the optimal program variation may be the basis for determining the programability effect. In addition to results of optimizing the system (program) as a whole on a critical path schedule, there will be variations formed for separate optimization of subsystems (subgoals, assignments, and subassignments). This is essential information for a quantitative evaluation of, for example, the additional effect from increasing the dimensionality of a system, that is, from coordinating these assignments into a single integrated program.

The methodological problems of determining program effectiveness have in many respects not been solved yet. Economic science should concentrate its efforts on working out these new and complex problems which are extremely timely in practical affairs. The approaches presented here to methods of determining the effectiveness of scientific-technical programs do not exhaust all issues, but they can be a definite step forward in study of this problem.

FOOTNOTES

1. Total expenditures for carrying out programs in the 11th Five-Year Plan will be 38 billion rubles, including 11.5 billion for scientific research and experimental design work and 5.3 billion for building experimental industrial installations (see Ya. Ryabov, "Questions of Development of Comprehensive Target Programs," PLANOVOYE KHOZYAYSTVO, No 10, 1981, p 5).

2. The nature of target programs leads to certain features of calculating their economic effectiveness which have been little studied. This prevents us from achieving essential results (see V. Krasovskiy, "The Effectiveness of Target Economic Programs," VOPROSY EKONOMIKI No 12, 1976, p 40).

3. Experience with 208 nationwide scientific-technical programs and 11 regional programs in the Latvian SSR during the years 1976-1980 showed that the main reason for failure to fulfill them was that they were not fully converted into assignments in the plan for economic and social development.

4. See B. A. Rayzberg, Ye. P. Golubkov, and L. S. Pekarskiy, "Sistemnyy Podkhod v Perspektivnom Planirovanii" [The Systems Approach in Future Planning], Izdatel'stvo "Ekonomika", 1975, p 34.

5. The analysis was made by junior scientific associates of the Institute of Economics of the USSR Academy of Sciences V. S. Farbirovich and L. A. Demidova.

6. See "Metodicheskiye Ukazaniya k Razrabotke Gosudarstvennykh Planov Ekonomicheskogo i Sotsial'nogo Razvitiya SSSR" [Methodological Instructions for Development of Plans of Economic and Social Development of the USSR], Izdatel'stvo "Ekonomika", 1980, p 13; "Raz"yasneniya po Zapolneniyu Kartochek Nauchno-Tekhnicheskikh Problem (Nauchno-Tekhnicheskikh Programm) Gosudarstvennogo Pyatiletnego Plana Ekonomicheskogo i Sotsial'nogo Razvitiya SSR" [Explanatory Notes to Filling out Cards on Scientific-Techn. al Problems (Scientific-Technical Programs) of the USSR State Five-Year Plan of Economic and Social Development], Moscow, 1980.

7. Substantiation of the indicator of net profit as the cost accounting effect of new technology is contained in the monograph "Nauchno-Tekhnicheskiy Progress i Ekonomika Sotsializma" [Scientific-Technical Progress and the Economy of Socialism], Izdatel'stvo "Ekonomika", 1979, pp 27-30, 185-196.

8. See "Osnovnyye Metodicheskiye Polozheniya Opredeleniya Sotsial'no-Ekonomicheskoy Effektivnostii Novoy Tekhniki" [Fundamental Methodological Principles of Determining the Effectiveness of New Technology], Moscow, 1980.

9. See T. S. Khachaturov, "Intensifikatsiya i Effektivnost' v Usloviyakh Razvitogo Sotsializma" [Intensification and Effectiveness in Conditions of Developed Socialism], Izdatel'stvo "Nauka", 1978, p 29.

10. The problem of adding together the vectors of the socioeconomic effect is set forth in greater detail in the book "Nauchno-Tekhnicheskiy Progress: Programmnyy Podkhod" [Scientific-Technical Progress: The Program Approach], Izdatel'stvo "Mysl'", 1981, pp 114-137.

11. See V. A. Lisichkin, "Otraslevoye Nauchno-Tekhnicheskoye Prognozirovaniye" [Sectorial Scientific-Technical Forecasting], Izdatel'stvo "Nauka", 1971; Dzh. Martino, "Tekhnologicheskoye Prognozirovaniye" [Technological Forecasting], Izdatel'stvo "Progress", 1977.

12. See "Nauchno-Tekhnicheskiy Progress i Ekonomika Sotsializma" [Scientific-Technical Progress and the Economy of Socialism], Izdatel'stvo "Ekonomika", 1979; M. Vilenskiy, "Technical Progress in the 10th Five-Year Plan," VOPROSY EKONOMIKI, No 11, 1976; V. Krasovskiy, "The Effectiveness of Target Economic Programs," VOPROSY EKONOMIKI, No 12, 1976.

13. K. Marx and F. Engels, "Soch." [Works], Vol 23, p 337.

14. See "Nauchno-Tekhnicheskiy Progress..." op. cit. FN 12, pp 39-41.

15. In his analysis of cooperation K. Marx noted that its advantages are not realized automatically. A necessary condition for it to be effective is control which "performs the general functions that arise from the movement of the entire production organism as distinct from the movement of its independent organs" (K. Marx and F. Engels, "Soch.", vol 23, p 342).

16. See, for example, "Sovershenstvovaniye Metodov Opredeleniya Effektivnosti Nauchno-Tekhnicheskogo Progressa" [Refining the Methods of Determining the Effectiveness of Scientific-Technical Progress], TsEMI AN SSSR, 1980.

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CSO: 1814/78

UDC 001.89

OVERCOMING OBSTACLES IN RESEARCH-PRODUCTION CYCLE

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 3, Mar 82 pp 42-47

[Article by Academician of the UkSSR Academy of Sciences Yu. S. Lipatov and L. V. Denisenko: "Science-Production: Efficacy of Mutual Ties"]

[Text] As analysis has shown, we still have lengthy periods for the realization of the achievements of science. According to a special study made by the authors in the Department of Chemistry and Chemical Technology (OKhKhT) of the Ukrainian SSR Academy of Sciences, 62% of the finished research and development does not have practical application for a long time, despite the high potential efficiency of the completed work. Therefore the institutes of the OKhKhT, like the entire UkSSR Academy of Sciences, have advanced to the forefront the questions of accelerating theuse of the results of scientific research in different sectors of the national economy, search for new and improvement in the existing forms of ties between science and production.

The detailed examination made by the authors of the efficient activitiy of the institutes of the OKhKhT to realize scientific developments has shown that often the obtained results are introduced at one-two enterprises and are not widespread in the sector (works of the Institute of Organic Chemistry, Institute of General and Inorganic Chemistry and Institute of Colloid Chemistry and Chemistry of Water). It is obvious that this introduction does not lead to a noticeable improvement in the efficacy of a certain industry as a whole and does not permit concentration of resources on solving strategic questions of developing enterprises, associations, sectors, although a lot of attention and forces are required from the scientific collectives and production engineers.

At the same time, purposeful developments as applied to specific sectors of the national economy and in close contact with the interested organizations (for example, the work of the Institute of Chemistry of High-Molecular Compounds for the Oil, as well as the Fishing Industry, the Institute of Organic Chemistry for medical, the Institute of Physical Chemistry and the Institute of Colloid Chemistry and the Chemistry of Water for the oil extracting, Institute of Gas for the metallurgical industry) made it possible to significantly accelerate the "science-production" cycle and expand the scales of introduction. For example, the introduction of "Sprut" and "Styk" type glues developed in the Institute of Chemistry of High-Molecular Compounds for repair of ship decks, decking and bulkheads made it posssible to reduce the time that the ships are in repair, diminish the outlays for materials by 65, labor intensity by 60, and total cost of repair operations by 61 percent.

Consequently, the output to a specific sector must become decisive for the academic science in setting up its ties to production and must encompass an ever greater number of sectors of the national economy. However, the specific nature of research done by academic institutions is such that one cannot always state in advance which sector the results will be used in. Because of its multiple-plan nature, the same work can be realized at enterprises of different ministries. This begins the most difficult stage of introduction: it is necessary to "penetrate" into the ministry, which often takes more time than the development itself. The tie between the institute and the ministry plays a special role in this case. Its efficiency can be improved by target financing, as well as by setting up certain intermediate links (permanent or temporary) which connect the academic science with applied. The intersector laboratories which are set up in the academic institutes for completion of target developments and technical assistance to the enterprises in mastering innovations may be one of these links. In addition, the appropriate applied work should be simultaneously in the plans of both the scientific institution and the enterprise of the interested ministry.

The probability nature of scientific research does not allow us to raise the question of introducing its results on all topics without exception. However there are frequent cases where the institutes refuse to recognize the inexpediency of using certain developments and from year to year continue to suggest them for realization in the national economy. There are also frequent cases where during the basic research the scientist obtains unforeseen valuable results of an applied nature which may not be considered in the integrated programs and coordination plans which have already been approved, often for a lengthy period. The interdepartmental commissions which include representatives of institutes and interested ministries could objectively and with economic substantiation solve the fate of the work proposed for introduction, and annually review and correct the coordination plans and programs, excluding not very promising work from them.

Many tasks of introduction can be solved especially successfully if there is initiative on the part of the enterprises themselves who have placed their tasks before the scientists or who have suggested using the results obtained in the scientific institutions. This cooperation will be fruitful of course if the tasks set by industry have sufficient scale and are well substantiated with regard for the outlook for development of this sector. One can cite corresponding examples from the practice of creative ties of a number of institutes of the OKhKhT and the industrial enterprises.

The composites developed in the Institute of Chemistry of High-Molecular Compounds based on large-capacity polymers have been used at the Syzran' plastics plant to make sheet items of thermoplasts for automotive manufacturing (without considerable outlays and change in the existing production processes). The economic effect from introducing them has been obtained by increasing the strength indicators by 10-20%, conserving the main material by 82% and in 1978-1979 was R 800,000.

The scientists from the Institute of Gas of the UkSSR Academy of Sciences have been involved in cooperation by the leadership of the Kaunass plant "Pirmunas" where in 1978 the first shop in the USSR for drying and roasting of enamel coatings was opened. All the heating equipment of the shop was made from developments of the institute.

However the appeals of production to science often have a particular nature and are determined by tasks of the present moment and the striving to eliminate tight places in its production instead of setting long-term problems for its development. Experience has shown that fulfillment of the majority of these assignments is within the capability of the workers of the actual industrial enterprises who often have first-class scientific equipment and their own highly skilled specialists with scientific degrees.

An important factor in the fruitful tie between production and science is also the creation by the enterprises of favorable conditions for solving the tasks set for them. This is primarily the presentation of an industrial base for major experiments, equipment and specialists. Although this system of interrelations has not yet been widely used, however, even now there are excellent examples of realizing this type of ties between science and production. This is, for example, the integrated program "UkSSR Academy of Sciences-association 'AvtoZIL'." A whole series of the most important production tasks has been effectively solved in a short period as a result of fulfilling it.

It should be noted that the integrated programs are one of the new forms of creative cooperation between the institutes of the UkSSR Academy of Sciences and industry which encompass the production process of the sector as a whole, the enterprise or its main subdivisions. Experience has shown that for more efficiency of these programs, the rights of their leaders should be broadened, target financing of the promising work and material encouragement should be provided for their timely completion and high-quality execution

The difficulties of the academic institutes in realizing their developments are often explained by the fact that the fulfillment of the plans for the development of new equipoment is controlled much less at the enterprises than the fulfillment of plans for the main production. In addition, in a number of cases, the use of an innovation is economically unprofitable for the enterprise. The interest of the enterprise in using new progressive developments whose economic advantages are evident on the scales of the national economy can be increased by improving the system of economic indicators of the enterprises associated with introducing the new equipment.

The analysis made by the authors has indicated that in the period of 1971-1979, the chemical scientists of the UkSSR Academy of Sciences suggested 1718 inventions of which only 31 percent were introduced at the country's enterprises. It turned out in this case, in particular, that over 80 percent of the indicated inventions remained unused in the national economy 4-5 years after completion of the work on them. The mastery of highly efficient inventions is very often delayed for many years. However objective analysis of all the aspects of utilizing the inventions in the national economy is difficult since in the majority of cases when an invention is introduced the enterprises do not at all report on the set form, and the work does not figure in the accounts as an introduced invention. For example, the Institute of Chemistry of High-Molecular Compounds asked the Central Scientific Research Institute of Patent Information and Technical-Economic Research for information on the use by the enterprises of the inventions of the institute scientists. It was found that in 1978 nine enterprises had reported on the set form about the introduction of five inventions with economic effect of R 275,800. However it followed from the documents that were given to the institute by the enterprises themselves that during this year 38 inventions were introduced at 48 enterprises with economic effect of R 9.4 million. The enterprises do not bear responsibility for distorting the account data. They also do not allocate the necessary resources for rewarding the authors of the inventions. Responsibility of the enterprises that have introduced the inventions should be increased to supply timely and correct accounts on the set form. It is also necessary for the enterprises to be obliged to report to the authors about the use of their work in production.

The conditions for economic contracts for the fulfillment of scientific research concluded between the scientific organization and the enterprise also do not stipulate either specific duties of the parties or responsibility for incomplete introduction. On the average, of the 40 contracts concluded per year by each institute of the OKhKhT, 75 percent stipulate completion of work with the introduction into production of the scientific results, but only 30 percent of them end with introduction.

Thus, the time has come to change the contract relationships between the research organizations and industry. The object of the contract must be not only the topic of the study, but also efficiency from introducing its results guaranteed by the enterprise if they correspond to the technical assignment. It is expedient to consider the end of the research work not the compilation and delivery of a report, but the achievement of the economic effect stipulated by the contract. The size of this effect must be confirmed by the act of introduction. It is also necessary for the departments to control the use by the enterprises of the results of economic contract work, as well as sanctions for violation of the introduction schedules.

We note in addition that the sizes of bonuses now depend to a small degree on the real contribution of the workers in the sphere of science to technical progress. The degree of rewarding the colleagues from the research institutes for successful completion of a contract topic is not defined anywhere. The development and introduction of a system for additional rewarding of the participants of the work done on the basis of economic contracts for their successful and timely introduction will also improve the efficiency of introducing the developments of scientific organizations into the national economy.

It is also expedient to disseminate the available experience of contract relations of the institutes from the Siberian Department of the USSR Academy of Sciences with the ministries and directly with the enterprises. The system introduced into the Siberian Department creates a guarantee for broad introduction of a new scientific idea into the sector and must be used among the other academic institutes.

Such a form of cooperation as the fulfillment of contracts for the transfer of scientific and technical documents makes it possible to consider the features of a specific enterprise and to bring the process of introduction at it to completion. However, the responsibility of the enterprises stipulated by the legislation for the failure of individual points in the conditions of this contract is currently insignificant. For example, the enterprises in order to reduce the size of the reward to the developers of the documents underestimate the volumes of product output in the first 2 years of use of the development, and refuse to introduce it altogether, while the institutes are deprived of any levers for influencing the enterprises. In addition, sometimes the customers avoid paying the bonuses stipulated by the condiitons of the concluded contract.

The introduction of developments of the institutes implemented in accordance with the contracts for creative cooperation is not included in the current plans of either the scientific institutions or the enterprises. Lacking juridical force, these contracts do not completely eliminate such negative phenomena as prolonged periods for agreeing upon developed problems, cases of interruption in the program, etc.

Questions of the industrial mastery of results of scientific research are closely tied to evaluating the efficiency of work of the scientific institutions, especially academic.

The institutes of the UkSSR Academy of Sciences introduced a new form of accounting starting in 1977, the so-called percentage economic effect.[1] However definition of this indicator until now has remained one of the most complicated and least worked out problems of evaluating the economic efficacy of scientific research.[2] Determination of the percentages of economic effect between the institutes and plants by agreement is now becoming more widespread. These percentages are most often selected equal. Certain institutes of the UkSSR Academy of Sciences, for example, the Institute of General and Inorganic Chemistry and Institute of Organic Chemistry define their percentage for certain developments as 90 or 100 percent. This distribution of the percentage participation has a purely formal nature and does not reflect the real contribution of the participants to the introduced development.

In the opinion of the authors, in order to evaluate the economic efficiency of the work of the academic institutes for which funds of economic stimulation have not been provided, it is necessary to take into consideration only

[1] See: "Metodika opredeleniya ekonomicheskiy effektivnosti nauchno-issledovatel'skikh rabot v uchrezhdeniyakh Akademii nauk Ukrainskoy SSR" [Technique of Determining the Economic Efficiency of Scientific Research in Institutions of the UkSSR Academy of Sciences], Kiev, Naukova dumka, 1978, p. 22

[2] See: Kurenkov, Yu. "Experience of Evaluating and Stimulating Scientific Research in the Textile and Light Industry,""Upravleniye, planirovaniye i organizatsiya nauchnykh i tekhnicheskikh issledovaniy" [Control, Planning and Organization of Scientific and Technical Research] (Proceedings of International Symposium of CEMA Member Countries and the Socialist Federated Republic of Yugoslavia), Vol 4, Moscow, VINITI, 1970; pp 238-241; Golosovskiy, S. I."Ekonomicheskaya effektivnost' issledovaniy i razrabotok"[Economic Efficiency of Research and Development], Moscow, Moskovskiy rabochiy, 1973; Dobrov, G. M.; Zadorozhnyy, E. I.; Shchedrina, T. I. "Upravleniye effektivnost'yu nauchnoy deyatel'nosti"[Control of Efficiency of Scientific Activity], Gen. ed. Dobrov, G. M., Kiev, Naukova dumka, 1978, p. 240.

the total national economic effect from introducing the research results, while it is inexpedient to compute the percentage economic effect. In fact, if the production engineers are very interested in some development, then they can develop it even without the help of the institute. Consequently, the percentage effect of the institute will formally be equal to zero or will be an insignificant part, while this will actually indicate the increased value of the development. Further, the plants generally on their own initiative do not report to the institute what economic effect was obtained as a result of the introduction of its development, and moreover, what percentage goes to the institute. They are not interested in this because the enterprises are rewarded for the new equipment completely and not by the percentage economic effect. There has not been a single case in the OKhKhT of the UkSSR Academy of Sciences where the plant appealed to the institute with a request to agree upon their percentage in the economic effect. Finally, if three and more partners participate in work associated with introduction, it becomes especially complicated to agree upon the sizes of the percentage economic effect.

Difficulties arise in confirming the percentage economic effect by the ministry which can hardly determine the degree of participation in introduction of its subdivisions on the one hand, and the developing institutes on the other hand.

As a result, determination of the percentage participation in introducing innovations has a conditional nature. The forms for statistical accounting of the enterprise indicate the actual economic effect. The authors therefore believe that it is more expedient to consider the total national economic effect obtained from introducing the developments of the institute in the repoarts of the academic institutes without consideration for the percentage participation of the executors, but with mandatory indication of the total number of organizations involved in the work on the topic and in its introduction.

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CSO: 1814/73

UDC 378.23

LEGAL REGULATION OF SCIENTIFIC WORKERS IMPROVES RESEARCH QUALITY

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 1, Jan 82 pp 41-46

[Article by Head of the juridical department of the USSR Academy of Sciences, Candidate of juridical sciences L. F. Petrenko: "Competition and Certification of Scientific Cadres"]

[Text] Since the first years of Soviet power, in addition to general norms for labor legislation which have covered the scientific workers, a broad circle of special norms has been active which set a special order for the development, change and halting of legal relations of scientific workers, their wages, pension payments, etc. In analyzing the legislation on the labor of scientific workers it is impossible not to note that many of its features are governed by objective prerequisites, and primarily, the importance of science and the transformation of it into a direct productive force. The specific nature of the legal position of the scientific workers is also tied to the creative, research nature of their work.

Features of the legislation regarding the labor of the scientific workers are very clearly manifest in the development of labor legal relations between them and the scientific institutions. There is currently an active unified order for selecting scientific cadres in all the scientific research institutions regardless of their departmental subordination. According to the decree of the CPSU Central Committee and the USSR Council of Ministers of 12 May 1962 No 441 "On Measures for Further Improvement in the Selection and Training of Scientific Cadres" and with the instruction approved by agreement with the AUCCTU by the decree of the Presidium of the USSR Academy of Sciences of 14 December 1962, vacant positions of the scientific workers of the scientific research institutions of the USSR Academy of Sciences, academies of sciences of the union republics, sector academies, ministries and departments are filled only by competition.

The competition serves as an additional condition which precedes the emergence of labor legal relations. In this case the decision of the scientific council (eliciting definite juridical consequences) is the chief and mandatory act for the administration in the competitive system of selecting cadres. The labor legal relations with the participant of the competition must only be set based on the decision of the scientific council and in accordance with them by the adminstration of the scientific institution.

The mandatory nature of the decision of the scientific council for the competition for the legality of establishing legal relations with the scientific workers is confirmed by the requirement of observing this juridical act in relation to resolving the question of awarding the scientific titles according to the statute on the order for awarding scientific titles. Consequently, only the observance of the competition guarantees complete rights of the scientific workers. The scientific workers who have been included for the position in violation of the active legislation without competition do not have the right to participate in the competition.

Before the selection by the scientific council, the scientific workers are considered temporary representatives in their offices, and the period for temporary execution of their duties cannot alter their legal position. However, these individuals may be discharged only because they were hired without the competition. According to the explanation of the State Committee of the USSR Council of Ministers on Questions of Labor and Wages and the AUCCTU Secretariat ofr 29 December 1965 No 30/39, an acting official (appointed to a vacancy) can only be released for grounds stipulated by the legislation. References in the order for temporary execution of the duties do not provide the grounds either for announcement of a competition or for discharge.

The competition for filling positions of scientific workers is aimed at guaranteeing the selection of the most qualified personnel for the work in scientific research institutes and laboratories. Observance of the competition procedure must create guarantees for an objective approach to evaluating the business qualities of the scientific worker and his correspondence to the occupied position,and exclude subjectivism in this matter. Many years of practice have confirmed the effectiveness of this system: competition as the main form of selecting scientific cadres promoted the attraction of skilled scientific workers to the scientific institutions of the USSR Academy of Sciences. But, unfortunately, the competition system is not sufficiently utilized in some scientific research institutions. This often results in hiring of random personnel for the positions of scientific workers. Hiring without competition also entails a violation of the labor rights of the scientifid workers.

I recall that according to the existing legislation, the hiring of temporary workers for a period of up to 2 months, including retirees, is done not for a vacant position but for a temporarily absent scientific worker (because of leave of absence, business trip, illness, etc.). Without announcement of a competition, individuals are also accepted to replace workers who have been sent for a lengthy business trip abroad. Acceptance for work in these instances is done on the condition of an emergence labor contract according to point 2 of article 10 of the Fundamentals of Legislation of the USSR and the union republic republics on labor.

In holding competitions, proper attention is not always given to the procedure for evaluating the cadres. At the same time, the observance of this procedure is necessary for the implementation of the Leninist principles of selecting and placing cadres. The lack of clearly formulated and juridically decreed requirements for each category of scientific colleague complicates the solution of problems associated with the hiring of scientific colleagues. It is therefore necessary to supplement the instructions on the order for replacing the positions of the scientific workers with a list of basic requirements made for the competition participants. This needs to be done because in a number of scientific institutions attempts are made to stipulate these requirements by orders and instructive letters.

The system for evaluating the activity of scientific colleagues which exists in our country generally has a common nature, is limited to listing the number amount of work done and statement of its brief contents. The official qualification characteristics approved by a decree of the State Committee of the USSR Council of Ministers for labor and social questions of 8 February 1978 No 38 only plays an auxiliary role in the competition process. It would be more correct to link the development of official qualification characteristics with the updating of legal norms regarding the order for replacing the offices of scientific workers.

Taking into consideration the positive experience of the competitive system of selecting cadres, it is time to pinpoint and expand the list of positions which must be filled by competition. A number of scientific research institutes have introduced positions of leaders of groups of scientific research subdivisions. The time of working in this position is counted in the length of service of scientific research work. The leader of the group very often heads the collective of senior and junior scientific colleagues. The question of the order for appointing to the position of the leader of the group, his election or recertification has not been answered in any one of the standard acts. It seems that this leader should be elected by competition. For these reasons, the instruction on the order of replacing the offices of scientific workers in scientific research institutions must be supplemented with the following statute: the list of positions subject to election by competition must include positions of leaders of the groups of scientific research subdivisions.

The list of positions of scientific workers that are filled by competition should also be pinpointed because in recent years (after the publication of instructions on competitions) in order to strengthen the material interest of the scientific workers in improving the efficiency of scientific research in individual scientific research institutions of different departments, new systems of paying the scientists were introduced as an experiment. (We are speaking of the Scientific Research Physical-Chemical Institute imeni L. Ya. Karpov, the All-Union Scientific Research Institute for Organization, Control and Economics of the Oil and Gas Industry and other institutions). Consequently, a number of scientific research institutions have introduced additional titles for positions of scientific workers: head of the section, head of the sector, chief specialist, leading researcher, senior researcher, scientific colleague, junior scientific colleague, etc. In this case, the positions "chief specialist," "leading researcher," "senior researcher," "scientific colleague" are not stipulated in any of the standard acts which define the order for hiring and firing scientific workers.

By a decree of the USSR Council of Ministers of 22 March 1967 No 237, the leaders of the scientific research institutions are given the right to formulate and confirm the structure and staff of the scientific-research institution as applied to the model structures and staffs. In the decision (order) on reorganization, the da for eliminating and organizing subdivisions or individual positions are indicated (with complete listing of their titles). The fact of selecting scientific workers according to the old (eliminated) structure loses its juridical value from the date of reorganization (elimination of the given subdivision or position) and does not provide the grounds for noncompetitive filling of vacant positions of the scientific workers according to the new structure.

The scientific colleagues of the eliminated subdivisions (positions) which during reorganization will not be accepted in the competition for vacant position in the new structure are released to cut down on the staff (point 1 of article 33 of the RSFSR Code of Laws on Labor) with payment of two-week severance pay. The release of scientific workers to cut down on the size of the staff is done with observance of the norms of labor legislation. Dissolution of the labor contract for point 1 of article 33 of the RSFSR Code of Law on Labor is not permitted without preliminary agreement of the local trade union committee, and the offer to participate in the competition equals an offer for specialized employment.

The 26th Party Congress has set high assignments for 1981-1985 for the development of science and technology. The USSR Gosplan, State Committee for Science and Technology, and USSR Academy of Sciences have formulated 160 scientific and technical programs, including 30 target intregrated programs which stipulate large-scale realization in the national economy of the most significant achievements of science. It consequently becomes necessary to rapidly change the structure and staffs of the scientific research institutions. Increase in work efficiency of the scientific organizations without increase in the number of scientific cadres is of especial importance.

It has been proven long ago that the successful development of scientific research depends not on the simple increase in numbers of scientific workers, but primarily on their correct selection, optimal placement and the most expedient use. This also determines the task of re-examining the formed principles of competitive selection of scientific cadres and their certification in order to convert this system into an efficient tool for improving the efficient of work of the scientific research institutions. This means the establishment of a clear order for changing the organizational structures of the scientific institution to bring them into correspondence with the changing subject matter, for elimination and reorganization of small and inefficient subdivisions, for concentration of scientific forces on the main, key trends in scientific and technical progress.

It is expedient to change the periods for selecting the scientific workers and to take them on for a period that coincides with the planned period for fulfilling the scientific work.

The active instructions for the order of filling positions of the scientific workers of scientific research institutions have established that every 5 years these workers (junior scientific colleagues every 3 years) should be appointed for a new period by the scientific council. The decision of the council in this case has the same juridical force as the decision on the results of the competitions. Thus, the individuals who have been hired without competition and who have passed selection at the scientific council acquire the right of the scientific workers hired by competition. (The agreement of the scientific worker for selection is not required; if he does not want to observe the order of selection (certification) established by the legislature, he can file for release or switching to another position where certification is not held).

The procedure of selecting for a position significantly differs from the holding of the competition. The competition is only held to fill a vacant (not occupied by anyone) position, and several applicants for one position generally participate in the competition. The selection of scientific workers for a new period is done by a schedule approved by the administration with the agreement of the local trade union committee and the higher organization. The schedule is approved in the beginning of each year and the scientific workers are informed. In addition, the leader of the scientific institution is obliged to notify in advance, but no later than 10 days before the meeting of the scientific council (section) the individuals selected for the new period, the date and place of the council (section) meeting. It is not recommended that more than five-seven scientific workers be selected at one meeting of the scientific council.

Before the scientific workers are selected to a position, they must report on the results of their scientific activity in the past period (five-year or three-year for the junior scientific colleagues). The heads of the scientific departments, laboratories, sectors report at the meeting of the council, the senior and junior scientific colleagues report in the scientific department, laboratory or sector. The scientific worker provides a report in written form for the period indicated by the administration. In addition, the meeting of the council or scientific subdivision hears his report. The nature of the oral report is determined by the scientific council which may be limited to answers of the scientific worker to individual questions.

The council of the scientific institution makes a decision about selecting the scientific worker for the position for a new period by secret vote. The decision is considered effective if no less than two-thirds of the council members participated in the voting. The scientific worker is considered selected if over half of the council members who participated in the selection voted for him. The scientific workers who are selected for the new term have the right to be present at the meeting of the scientific council to discuss their questions. If the scientific worker is absent from the meeting without valid reasons, the question of selection can be examined in his absence. In this case, the council hears a report of the leader of the subdivision where the scientific worker works, and makes a decision by voting.

The scientific worker can ask for a secondary examination by the council of the question of his selection to a position if he was not present at the meeting of the council for a valid reason (for example, sickness, leave of absence, business trip) or if he was not notified of the time and place of the council's examination of the question of his appointment to the position.

The scientific workers that are not selected by the council for the new term are released from work in the scientific institution or are transferred to lower offices (noncompetitive). The following is entered in the work book of the released workers: "Released because of lapse of work term set by the legislature on competitions."

It would have been useful to make the statute standard which states that during the selection for a new term, as the suitability of the scientific colleague for the next higher position is clarified, the scientific council could make a suggestion about transferring him to this higher position. This requires the introduction of several ranks both for junior and for senior scientific colleagues with a difference in the position salaries.

The active instructions for the order of filling positions of scientific workers also stipulate a special, exceptional case for release: the leader of the scientific institution has the right to fire or demote a scientific worker before the end of the five-year or three-year period if he has not shown a positive side in its scientific work. The basis for this firing or demotion is the decision of the council about the noncorrespondence of the worker to the occupied position made by secret vote. The resolution of the question must generally be preceded by verification of his work by a special commission appointed by the director of the scientific institution from the members of the council, as well as representatives of the social organizations. The commission provides the council with its motivated conclusion, and the workers must be acquainted with its contents and the materials of the check before the meeting of the council.

The order for firing a scientific worker because he does not fit the position also needs pinpointing. It is extremely important to define the sample list of grounds for firing a scientific worker, including cases where he did not show a positive side in scientific work, and also when his noncorrespondence is determined by amoral behavior, especially in educational functions (supervision of post-graduate students or scientific subdivisions).

According to the decree of the CPSU Central Committee and the USSR Council of Ministers of 24 September 1968 No. 760, a number of measures were adopted to improve the results of scientific activity. The USSR Academy of Sciences, sector academies, academies of sciences of the union republics, ministries and departments have been entrusted with evaluating no less than once every 3 years the activity of the scientific research institutions under their jurisdiction. The results of this evaluation must be used to make a decision on their further development, additional material incentive for the collectives. The evaluation of the activity results of the scientific institution should be considered in the certification, and material stimulation should be more widely used to increase the efficiency of the scientific work. It is necessary to considerably strengthen the efficiency of the economic levers and stimuli, having placed material incentive in direct dependence on the efficiency and quality of work and the fulfillment of the planned assignments.

Legal regulation of the labor of the scientific workers is one of the most important methods of state supervision of science. From here we have the need to improve the order for filling positions of the scientific workers and other statutes on their labor. The legal grounds for training and certifying need to improve the order for fulfilling the positions of scientific workers and other statutes on their labor. The legal principles for training and certification of scientific cadres must be secured in legislation and at the same time promote an improvement in the efficacy of scientific research.

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CSO: 1814/76

APPROVED FOR RELEASE: 2007/02/09: CIA-RDP82-00850R000500080032-3

UDC 207.2

SOVIETS ACTIVELY PARTICIPATE IN INTERNATIONAL 'MAN AND BIOSPHERE' PROGRAM

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 4, Apr 82 pp 77-84

[Article by Academician V. Ye. Sokolov and Candidate of biological sciences G. V. Nizhnik: "In the Soviet Committee on the Program 'Man and the Biosphere'"]

[Text] In 1970 the 16th Session of the General Conference of UNESCO adopted the international program "Man and the Biosphere" (MAB from the English Man and the Biosphere). This program which was instituted by UNESCO because of the ever increasing effect of man on the environment was called upon to guarantee on the basis of comprehensive basic research the production of scientific data needed for the efficient use of natural resources and control of processes occurring in nature.

The program stipulates the use of the experience of certain other international programs, in particular the International Biological Program. But in contrast to it, the new program, in addition to studying the changes in the natural processes occurring in the biosphere under the influence of human activity, also focuses attention on investigating the effect of these changes on man himself. Specialists of the most diverse fields of knowledge have been involved in the work, including representatives of the humanities (sociologists, economists, etc.), that is the program has a clearly pronounced interdisciplinary nature. It stipulates the organization and conducting in different regions of the world of comprehensive studies on the investigated problems. Supervision of the work and observation of its fulfillment has been entrusted to the International Coordination Council which includes representatives of 30 states, including the USSR. At the last Seventh Session of the council which took place in Paris from 30 September to 2 October 1981, the following were elected to its staff: chairman Balla Keyta (Ivory Coast) and four vice-chairmen V. Ye. Sokolov (USSR), D. King (United States), R. Neto (Brazil) and Yan Hanshi (Chinese People's Republic).

The first session of the council in November 1971 suggested 13 projects for international cooperation, and in 1974 upon the initiative of the Soviet scientists the program was supplemented with a 14th project: "Study of Environmental Pollution and Its Effect on the Biosphere." In addition, according to the recommendations of the first conference on coordinating the activity of the national committees on the program "Man and the Biosphere" (Moscow, March, 1977), four working groups were additionally set up: for environmental protection education and training of cadres; for socioeconomic problems of the interaction of man and the biosphere; for systems analysis and mathematical modeling; for scientific and technical information.

The UNESCO program "Man and the Biosphere" currently includes the following projects.

Project 1--"Ecological Effect of Increasing Human Activity on the Tropical and Subtropical Forest Ecosystems." Project 2--"Ecological Effect of Different Types of Land Use and Management Practice on Forests in the Temperate Zone and Mediterranean" (subproject 2a--"Ecological Effect of Man on Taiga Ecosystems"; subproject 2b--"Effect of Human Activity on Vegetation, Environmental Protection Properties and Productivity of Forest Ecosystems of the European Sector of the USSR.") Project 3--"Effect of Human Activity and Methods of Land Use on Pasture Land: Savanna and Grassy Landscapes (from Moderate to Dry Regions".) Project 4--"Effect of Human Activity on Dynamics of Ecosystems of Arid and Semiarid Zones, Including Use of Pasture Lands and Consequences of Irrigation." Project 5--"Ecological Effect of Human Activity on Resources of Lakes, Swamps, Rivers, Deltas, Estuaries and Coastal Regions." Project 6--"Effect of Human Activity on Mountain and Tundra Ecosystems" (subproject 6a--"Effect of Human Activity on Mountain Ecosystems"; subproject 6b--"Effect of Human Activity on Tundra Ecosystems.") Project 7--"Ecology and Efficient Use of Island Ecosystems." Project 8--Preservation of Natural Regions and Genetic Material Contained in Them " (subproject 8a--"Biospheric Preserves"; subproject 8b--"Species and Its Productivity in the Geographic Ranges.") Project 9--"Ecological Evaluation of the Control of Agricultural Pests and Use of Fertilizers in Surface and Water Ecosystems" (subproject 9a--"Ecological Evaluation of the Consequences of Using Fertilizers in Surface and Fresh Water Ecosystems"; subproject 9b--"Ecological Consequences of Systematic Use of Pesticides and Other Means of Controlling Harmful Organisms in Surface and Fresh Water Ecosystems.") Project 10--"Effect of Main Types of Engineering Operations on Man and His Environment." Project 11--"Ecological Aspects of the Municipal Systems with Special Emphasis on the Use of Energy ("Ecological Aspects of Settlement")." Project 12--"Interaction between Transformations of the Enviroment and Adaptive, Demographic and Genetic Structure of the Population." Project 13--"Understanding of the Condition of the Environment." Project 14--"Study of Environmental Pollution and Its Effect on the Biosphere."

Over 100 countries participating in the work on the program have set up national committees which select the most urgent trends in research for their countries and guarantee international cooperation for their implementation. Work was done 2 years ago on 396 scientific topics, but now the number of developed topics has risen to 906 and a considerable number of them cover the effect of human activity on the main types of natural communities: tundra, forests of the temperate zone, subtropics, tropics, savanna, steppe and desert, islands and mountains, basins and coastal regions. Ways are also being sought for preservation of the different natural regions and genofund of animals and plants. The effect is being established of pesticides, herbicides and mineral fertilizers on the environment, reasons are being specified for the decreased efficiency of chemical control of agricultural pests, etc. As a result of the studies, scientifically substantiated forecasts should be made for changes in the biosphere and recommendations should be made aimed at guaranteeing wise economic activity of man and permitting the combination of material and spiritual welfare of people with normal functioning of the biosphere.

The Soviet committee on the UNESCO program "Man and the Biosphere" was set up at the end of September 1975. But it actually began to operate in 1976, therefore 1981 became sort of an anniversary for it since the committee summarized its activity for 5 years. This article should present an idea about these results, but a journal article is not a report, therefore it will only name individual results as examples characterizing the committee's activity.

The basic tasks of the Soviet committee on the UNESCO program "Man and the Biosphere" are to coordinate and direct the scientific research on this program in our country, and also provide a link to UNESCO and other international and national organizations involved in problems of studying and protecting the biosphere and the efficient use of its resources. The committee consists of an office, secretariat, scientific coordination council, working groups and republic committees which directly organize work for the program. The chief institutions for almost all projects on which work is done in the Soviet Union are the institutes of the USSR Academy of Sciences and the academies of sciences of the union republics, and only for two projects (1 and 14), as well as for one working group (for education and training of cadres) the institutions of other departments (USSR State Committee on Forestry, USSR State Committee on Hydrometeorology and the Moscow State University respectively). The organizational support for work of the committee has been entrusted to the Institute of Evolutionary Morphology and Ecology of Animals imeni A. N. Severtsov of the USSR Academy of Sciences.

A total of 22 working groups have been formed and are actively working. They plan and monitor the fulfillment of research in the Soviet Union in the framework of their project or problem, and some guarantee cooperation and coordination of research on a regional level for all the countries of socialist cooperation: they develop model research programs, pinpoint the technique, hold meetings of experts on the most urgent problems. The republic committees set up in all the union republics and working on in-house programs of scientific research programs under the supervision of the Soviet committee play an important role.

In the past period, many regions of the USSR have evolved comprehensive studies which investigate the changes occurring in the biosphere and its components under the influence of human activity. It should be said that only 2 countries are working on all 14 international projects, the USSR and Australia. UNESCO took an inventory in July 1979 of the scientific research topics whose development had begun in 1976. Our country registered 246 of these topics that referred to all 14 projects. This is the greatest number of topics for one separate country. Australia, for example, registered 64 topics and the other countries considerably fewer.

The projects which are included in the program cover the most diverse problems. For example, the main task of the project "Ecological Effects of Different Types of Land Use and Practice of Management on the Forests in the Temperate Zone and the Mediterranean" (we have 45 topics) is to formulate fundamentals for the efficient use of the taiga and mixed forests and to establish ways to increase their productivity, and special attention is focused on creating methods for forecasting the nature of the response of the forest ecosystems to anthropogenic interference.

According to this project, the USSR has completed the first stage in studying the cedar forests of the Urals and the West Siberian plain. The basic laws have been revealed which cover the restoration and age dynamics. The ages of maturity of the cedar forests of varying biological and economic importance have been defined. Basically new statutes have been preliminarily formulated for managing the cedar forests with regard for their restorative-age dynamics. There are a number of suggestions and developments for efficient use and restoration of the taiga ecosystems. In particular, methods have been suggested for studying the post-fire dynamics of forests with the use of aerial and space photographs, as well as a technique for mapping this process. The results of studying the water protection role of forests of the Lake Baykal basin have been the basis for forestry management in this region.

A no less amount of work has been done in relation to the mixed and broad-leaved ecosystems. Information is primarily accumulated and generalized regarding the productivity of the forest ecosystems in the European secter of the USSR depending on their composition, age, type of forest, etc. Ranges of fluctuation in the most important environmental factors have been revealed, and correlations have been defined between them and the horticultural composition, structure and productivity of the communities. Processes of differentiation and falling of adult trees in the climax taxons have been studied in special detail as a reaction to the high population density, and as a result of competition for solar energy, water and food resources of the ecosystem. The nature has been revealed of adaptive rearrangements in the structure of the assimilation apparatus and suction roots of spruce stock in critical weather situations.

The materials of these and other studies were the basis for a flowsheet and practical measures for protecting the spruce forests of the large state sanctuary Verkhenvol'zhye (Central Forest State Preserve of the USSR Ministry of Agriculture) where a system was set up for sample reference areas to organize studies on the program of biospheric preserves.

An important part of the work is to evaluate the effect of meliorative systems on the productivity of forest types. It was found that decrease in the level of subsoil water during meliorative operations to 0.5 m in the majority of cases does not reduce the productivity of forests, but can cause temporary reduction in their growth. With a decrease in the level of subsoil waters in limits of 0.5-1 m, the change in productivity can, depending on other conditions, be positive, neutral and negative. With a decrease in the level of subsoil waters by more than 1 m, the productivity of tree stocks diminishes. As a result of the conducted studies, an approximate scale has been compiled for the effect of reclamation on the productivity of phytocenoses and recommendations have been worked out for the establishment of biological productivity of forest communities depending on their water supply. Recommendations have been drawn up for isolation and preservation in the natural state of valuable landscapes and objects of vegetation (landscape sanctuaries, botanical sanctuaries and monuments of nature)during meliorative construction.

Work has also been active for the project "Effect of Human Activity and Methods of Land Use on Pasture Land" (seven topics). Scientific fundamentals have been formulated for the efficient use of pasture land in different climate, social and economic conditions. In particular, the economic processes have been investigated in the Ukrainian steppes, the role of human economic activity in the evolution of modern biogeocenoses has been evaluated, and specific suggestions have been made for improving the natural steppe vegetation and its protection. Procedures for radical and surface improvement of the natural feed crops of the Donbass have been developed and introduced using local species and forms of perennial feed plants and those from other regions.

Recommendations have been introduced into practice for the efficient use and improvement in pasture lands which stipulate the regulation of cattle grazing by seasons, standardization of the load, introduction of fallow pastures, planting of valuable feed grasses, application of fertilizers, irrigation of the steppe plots, etc.

A technique has been formulated for evaluating the degree of anthropogenic degradation of the ecosystems. This is of great practical importance. Maximum permissible loads have been set for individual categories of ecosystems. Studies have been made of the structure, dynamics and anthropotolerance of populations of a number of endemic plants in the Urals and Ural region. Scientific fundamentals have been formulated for protecting rare plants in these regions (the materials have been included in the regional "Red Book"). A series of forecasting charts have been prepared for the forest-steppe Ural region on changes in the nature of the vegetation in the next 20-50 years under anthropogenic loads of varying strength. In the development of the procedures for improving productivity of the mountain pasture lands and hay fields of Tadzhikistan it was established that the surface use of mineral fertilizers improves the productivity of low-grass and large-grain semisavannas, mountain steppes, meadows and prickly grasses 2-4-fold. It has been shown that each plant species has a unique reaction to the application of fertilizers and as a consequence the structure of the herbage changes.

The work on the project "Effect of Human Activity on the Dynamics of the Ecosystems of Arid and Semiarid Zones, Including the Use of Pasture Lands and the Consequences of Irrigation" (22 topics) is very important for our country. Basic research on the project is aimed at clarifying the laws governing the structural-functional organization of the desert biogeocenoses, dynamics and evolution of their main components, as well as the development of fundamentals for the efficient use of the desert resources and improvement in its productivity. In particular, the morphological differentiation and multiple-year dynamics of the landscapes in the east Karakumy have been investigated.

Within the framework of the project, experiments are successfully being carried out to use space equipment to investigate the natural conditions of the desert. It is understandable what importance the space methods have for studying territories of the desert of difficult access, especially if one considers that an increase in the rates of development of new lands and intensification of the anthropogenic effect on the nature of the desert requires an effective system of rapid monitoring of the changes in these territories and control of their natural processes.

Studies of the spectral reflectivity of the vegetation, soils and other natural components in different regions of Turkmenistan made it possible to determine the optimal seasonal periods and informative spectral intervals for aerospace photographs to solve a number of scientific and practical tasks.

A lot of attention is focused on the development of basic method conclusions for mapping the natural processes from large-scale aerial photographs. These maps make it possible to qualitatively evaluate the condition of the environment and obtain quantitative data on the intensity of certain processes occurring in it. New thematic maps have been compiled: landscape map of Turkmenistan (scale 1:2,500,000), soil (1:1,000,000) and map of vegetation in the zone of influence of the first phase of the Karakum canal and the adjoining territories. These maps are viewed as the first stage in implementing the ecological monitoring of desert ecosystems.

Scientific fundamentals have been formulated for enriching the existing natural and creating artificial desert biogeocenoses. Work is underway to improve the methods of securing moving sands and comprehensive development of low-productive sandy soils. A total of 426 species and types of feed crops have been introduced from the countries of Asia, Africa and Latin America. Ten of them proved to be the most stable under the harsh conditions of Karakumy and yield high harvests of grain for silos.

Social and economic studies of the consequences of the effect on arid ecosystems of anthropogenic factors, including those associated with irrigation and interbasin redistribution of run-off are becoming more widespread. Calculations have been made for this purpose to determine the economic efficiency of transferring part of the run-off of the Siberian rivers into the central region. According to preliminary data, implementation of the first phase of run-off transfer developed by the planning organizations will not result in considerable changes in natural conditions on large-regional scales, although it will significantly affect local features of the environment, and the nature of local changes may vary in fairly broad limits depending on the specific technical solutions, local natural and economic conditions.

It should be said that the problem of transferring part of the run-off of the northern rivers of the country occupies a large place in the studies on the project "Effect of Main Types of Engineering-Technical Work on Man and His Environment" (14 topics). At the current stage of development of productive forces, this complicated ecological-economic problem is an important part of the general problem of efficient use of nature, while its resolution is aimed, in particular, at scientific substantiation for the measures to control water resources of the dry land as the most important component of the biosphere and element of productive forces of society.

A comprehensive analysis has been made in the project of the negative consequences of territorial redistribution of water resources and specific recommendations have been drawn up for their maximum possible prevention. Engineering-economic solutions have been analyzed for the project of territorial redistribution of run-off from the viewpoint of guaranteeing protection of nature, improvement in the use of natural resources and improvement in the living conditions, state of health and activity of the population. The appropriate recommendations have been formulated.

One of the projects especially covers the problems of water resources, "Ecological Effect of Human Activity on the Resources of Lakes, Swamps, Rivers, Deltas, Estuaries and Coastal Regions"(16 topics). Primary attention here was aimed at investigating the biology of aquatic organisms and the effect of pollution on the composition and production processes of aquatic biocenoses. Recording has been done and a cadaster has been compiled for 414 of the largest lakes in Belorussia and this was the basis for recommendations for their efficient use and improvement in their water regime. The results of these studies were considered in the development of a unified network of protected territories of Belorussia and organization of lake sanctuaries. It has been shown that the effect of economic activity has been felt by the absolute majority of lakes of Belorussia, and this entails the development of processes of eutrophication because of the influx of biogenic substances, primarily phosphorus and nitrogen. Practical recommendations have been prepared for decreasing the rates of eutrophication of the republic's basins.

Method principles have been formulated within the project for forecasting the changes in the resources of surface waters of Belorussia, the Ukraine and Moldavia, and a quantitative evaluation has been made of these changes for the calculated levels of 1980, 1985, 1990 and 2000.

New criteria have been formulated for removal and use of water resources with regard for the hydrological features of the water objects. In addition to this, a survey has been made of the Soviet and foreign experience for comprehensive evaluation (bonitation) of the natural resources of the river ecosystems for their most efficient economic use. The bonitation was carried out for the balance of phosphorus and nitrogen, and based on an estimate of the main natural elements of the river ecosystems: lowland meadows, fish resources and commercial hunting fauna. The results of this work have been transferred from practical use.

The Soviet scientists have done a lot on the project "Preservation of the Natural Regions and the Genetic Material Contained in Them" (25 topics). The main goal of the project which is quite new and has not figured in the previous programs of work is to create a world network of biospheric sanctuaries and to guarantee protection of the genofund of the main types of ground and fresh water ecosystems.

Biospheric sanctuaries are a component part of the system of global ecological monitoring. Their tasks include the preservation of the genofund of living organisms and reference ecosystems, observation of the condition of the ecosystems and their individual components both on territories whose natural resources are not exposed to direct economic use, and on territories which are under anthropogenic influence, development of methods for predicting the changes in the condition of the environment, forms and strategies for controlling natural processes, as well as methods of ecological education, that is, training in a correct attitude towards nature.

In the past period, the USSR has created the first phase of biospheric sanctuaries (Caucasus, Repeteksiy, Central Chernozem, Sikhote-Alin'skiy, Prioksko-Terrasnyy, Berezinskiy and Sary-Chelekskiy), which have been included in the world network by a UNESCO decision. The first samples of the future unified monitoring system have been successfully set up on the basis of some of these preserves. In order to fulfill the monitoring program in each biospheric preserve, not only are studies made which are common for all sanctuaries which clarify the effect of pollution on the environment, but regional tasks are solved which are associated with clarifying the effect on certain ecosystems of different types of economic activity. This trend in the work will considerably foster the conducting of zonal-regional measures for environmental protection, and at the same time provide the most important material for development of the most effective ways of realizing complicated and multiple-plan tasks associated with the observance of the condition of the environment, its protection and efficient use.

Improtant studies are being made in the framework of this project on the problem "Species and Its Productivity." It is proposed, in particular, that the solution to the tasks of environmental protection and the efficient use of biological resources be based on data obtained from studying individual animal species. Thus the studies of the earthworm of the species Eisenia nordenskioldi indicated that it may prove promising for settlement in isolated foci of farming in the European northern USSR where there are practically no dead organic residues in the arable lands because of the lack of earthworms. The species of pincher tick Nothrus palustris will probably prove suitable for bioindication of industrial and radioactive pollution. The species Chironomus plumosus L. (midges) are a convenient subject for studying the effects of an anthropogenic factor on the environment: it was found that the adaptation of this species to changes in the environment is accompanied by the appearance in its karyotype of additional chromosomes. Investigation of the distribution and ecology of the roe deer Capreolus capreolus will significantly improve its hunting.

The introduction of a unified system for collecting, processing, accumulating and issuing data on species of animals and organization of "banks" of biological information will have great significance for solving questions of preservation and efficient use of resources of the animal world. A prototype has currently been set up in the Institute of Zoology and Parasitology of the Lithuanian SSR Academy of Sciences, the main institute for work in this area.

Finally, it is impossible not to stress that the initiators for including into the project such a project which is exceptionally urgent in our time as "Study of the Pollution of the Environment and Its Effect on the Biosphere" (19 topics), the Soviet scientists, made a weighty contribution to its realization as well. For example, mathematical models were formulated for the dispersal of pollutants, several levels of pollution of basins, soil, vegetation and atmospheric air of populated areas were established, for the first time in the practice of hygienic studies a systematic characterization was made of the main types of industrial sources of environmental pollution with carcinogenic hydrocarbons, measures have been formulated to decrease the degree of pollution of the atmosphere, soil and water in regions of a number of major industrial facilities, etc.

It is already obvious from the listed diverse examples that the author of this article had to be limited to that the research conducted on the program generally not only has great scientific, but also practical importance. This is characteristic for the work of the Soviet scientists on all the projects, and many results of the work have already been introduced or are being introduced into practice.

The Soviet scientists continue, expand and deepen studies on the international program "Man and the Biosphere." It should be noted that they take an active part in the work on all aspects of the program, including economic, sociological, legal, cultural, etc. The main feature of this program is that specific problems are resolved in its framework which meet the requirements of the participating countries. The Soviet committee for the program "Man and the Biosphere," in formulating plans for activity of our scientists, started from and start from the decisions of the 25th and 26th CPSU Congresses who have set the ecological problem, the problem of environmental protection and the efficient use of natural resources among the most important state tasks.

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CSO: 1814/74

UDC 001.89

ACADEMIES OF SCIENCE AND REPUBLIC VUZ'S TO STRENGTHEN TIES

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 12, Dec 81 pp 32-35

[Report by Academician A. A. Logunov, vice-president of the USSR Academy of Sciences, presented by Academician N. G. Basov: "Concerning the Further Development and Strengthening of Relationships Between the Union-Republic Academies of Sciences and Higher Educational Institutions"]

[Text] The 26th CPSU Congress laid out a vitally important program for the economic and social development of our country for the 11th Five-Year Plan and for the period up to 1990. In his report at the congress, Comrade L. I. Brezhnev especially stressed that, for the successful implementation of this program and the fuller development of our economy in the 1980's, it is necessary to accelerate scientific-technical progress in every way possible and, consequently, increase the output of Soviet science even more. The "Basic Directions for the Economic and Social Development of the USSR for 1981-1985 and for the Period to 1990," adopted by the congress, also planned for increasing the effectiveness of utilizing the scientific potential of the country's VUZ's, along with the development of science within the system of the USSR and union-republic academies of sciences.

Our country's higher schools at present have a large scientific potential. In them there are over 30,000 departments, 60 scientific-research institutes, about 1500 laboratories oriented toward problems or economic sectors, and about 450 scientific-research sectors, computer centers, botanical gardens, observatories, museums, and experimental design bureaus. The staffs include over 500 academicians and corresponding members of the USSR and union-republic academies of sciences who actively participate in the training of specialists and in the organization and conduct of scientific research. About 60,000 students of formal postgraduate programs and a significant number of undergraduates are actively engaged in scientific research in higher schools.

The USSR Academy of Sciences attaches a great deal of significance to interaction with VUZ's and to the development of creative relationships with them. With close contact with the USSR and RSFSR Ministries of Higher and Secondary Specialized Education, the presidium of the USSR Academy of Sciences for many years has given practical assistance to VUZ's in training specialists and has given methodological assistance in developing scientific research in the most urgent areas of present-day science.

According to a plan approved by the presidium of the USSR Academy of Sciences, over 400 scientists go out to VUZ's around the country every year to give lectures and provide aid in scientific-methodological work. Just during the years of the 10th Five-Year Plan, about 2000 scientists, including over 200 academicians and corresponding members of the USSR Academy of Sciences, went out to the country's VUZ's.

Fruitful relationships in the training of specialists and in the cultivation in them of scientific-research work habits have been established between the USSR Academy of Sciences and the Moscow Physical-Technical Institute. The distinguishing feature of these relationships is provision by the academy to the Physical-Technical Institute of institute facilities where students of senior courses obtain deep specialization and the possibility of mastering new areas of science.

A special department, organized jointly with the Physics Institute imeni P. N. Lebedev of the USSR Academy of Sciences, has operated at the Moscow Engineering-Physics Institute for over ten years. This department prepares undergraduates and graduates, using current achievements of academy physics institutes in individual programs with consideration for the interests of the institute that sent the student there.

Experience in creative relationships between the USSR Academy of Sciences and the Moscow Physical-Technical and the Moscow Engineering-Physics Institutes could be usefully transferred to the union republics. In a number of academies of sciences it is already in use to a certain degree.

An important role in the further development of science in republic higher educational institutions was played by the decree of the CPSU Central Committee and USSR Council of Ministers No. 271 of 6 April 1978 "On Increasing the Effectiveness of Scientific-Research Work in Higher Educational Institutions." A large amount of attention is being given to this problem also by directive bodies of union republics' reflecting this in special decisions. In many republics, councils or commissions for relations with higher schools have been created under the academies (AzSSR, ArSSR, GSSR, LaSSR, MSSR, UzSSR, and ESSR).

The measures that have been introduced have made it possible for creative relationships between republic VUZ's and republic academies of sciences to grow and strengthen significantly. At the present time, forms of creative cooperation have evolved and proved themselves, such as VUZ participation in joint research with academy institutions in the natural and social sciences, agreements for creative cooperation, work according to unified coordination plans and inter-VUZ special-purpose scientific-technical programs, joint publication of scientific works and teaching aids, and conduct of joint scientific conferences. Many scientists from the republic academies take part in the training of specialists at VUZ's, give special courses of lectures, and provide scientific-methodological assistance. About 300 scientists from republic higher schools are active members or corresponding members of republic academies of sciences and, in a number of republics, their number reaches 20 to 30 percent of the total number of academy membership. Many VUZ scientists work actively in problem councils. The practice of joint projects between VUZ's and academy institutions on important scientific and scientific-technical problems has begun to expand; the number of VUZ projects in coordination plans of academies has increased; and certain VUZ's have begun to participate in the development of long-term complex programs. Thus, the coordination plan of the Kazakh SSR Academy of Sciences at the present time has up to 300 research projects of republic VUZ's; the Latvian SSR Academy of Sciences plan has over 120 projects; and the Lithuanian SSR Academy of Sciences plan has 240 projects (which constitutes about 50% of all projects in the coordination plan of this academy). Scientists of Moldavian VUZ's are co-performers in 15 republic multi-sector scientific-technical problems and 20 problems in the natural and social sciences. The Kazakh SSR Academy of Sciences is having good results in joint research with VUZ scientists in projects in the fields of chemistry, metallurgy, biology, and mining. The Turkmen SSR Academy of Sciences is successfully conducting complex research in cooperation with soil-science personnel from the Leningrad and Tashkent Agricultural Institutes in developing measures directed toward the effective use of land resources, espe cially deserts. The Uzbek SSR Academy of Sciences has developed practical measures for joint utilization with VUZ's of unique scientific equipment. During the last three years, it has transferred scientific equipment and instruments worth a total of about 500,000 rubles to VUZ's without compensation.

Scientists of the Latvian SSR Academy of Sciences are cooperating successfully with republic VUZ departments in urgent projects in organic synthesis, physics of solids, problems in machine building, and in other fields of research.

The program for scientific cooperation for 1980-1981 between the Moldavian Academy of Sciences and the republic Ministry of Higher and Secondary Specialized Education provides for joint work on 70 scientific developments, 53 special lecture courses by academy scientists, and more than 20 joint conferences and meetings; proposals are being developed for joint creation and operation of scientific-experimental facilities and nonstandard equipment.

A large amount of attention is being given to the development of creative relationships between academy institutes and VUZ's by the presidiums of the academies of sciences of the Ukraine, Belorussia, and Tajikistan. In the Armenian SSR Academy of Sciences, this question has become a subject for discussion at a special session of the republic Council for Coordination.

The transition to special-purpose-program planning of scientific developments has had a positive influence on the development of cooperation between republic academies of sciences and republic VUZ's. As a result of this, creative relationships between academies and VUZ's in individual republics have acquired a long-term basis, concentration of forces and resources on the most important areas of scientific-technical progress has been intensified, and the degree of complexity and level of research has been raised. As an example, one can cite the Belorussian SSR Academy of Sciences where, under the 10th Five-Year Plan, over 20 VUZ's took part in the development of 20 most-important republic complex programs. In Kirghizia, republic VUZ's accomplished, together with the Academy of Sciences, the development of four complex programs as well as 116 topics in the general coordination plan.

Close scientific cooperation between institutions of the union-republic academies of sciences and VUZ's was planned also for the 11th Five-Year Plan and undoubtedly will facilitate the further development of fundamental and applied research, increase its effectiveness and, at the same time, fulfill the directives of the 26th CPSU Congress.

In evaluating the status of creative relationships between higher schools and union-republic academies of sciences, it must be recognized that, in this important matter, far from all existing reserves are being exhausted yet.

VUZ's in the republics do not sufficiently utilize the capabilities of republic academies for training, especially special-purpose postgraduate training programs. The capabilities of the USSR Academy of Sciences also are not fully used for this purpose. On the other hand, scientists of republic academies still do not participate sufficiently in educational-teaching work in VUZ's and give special lecture courses too infrequently. Considering the rapid development of science and its practical application, it seems important that the content of educational programs and lectures in VUZ's reflect the maximum in latest scientific achievement. This, in turn, presupposes serious work in systematic examination and renewal of curricula, programs, lecture courses, and laboratory work. In correspondence with this, the subject matter of students' course and diploma projects also should be changed. Hence, it follows that constant direct participation by leading scientists from republic academies in the scientific-educational process and in the preparation of textbooks and teaching aids is extremely necessary. Speaking of educational work and, especially, of inculcating students with the interest in and habits of research, it would be advisable to recommend to VUZ's and union-republic academies of sciences that they utilize more widely the experience of the USSR Academy of Sciences and the Moscow Physical-Technical Institute, the Moscow Engineering-Physics Institute and Novosibirsk University, and also the UkSSR and BSSR Academies of Sciences, for combining the teaching process with scientific-research work at institutes of the academies of sciences. At the Ukrainian SSR Academy of Sciences, at several academy institutes, departments of the Moscow Physical-Technical Institute have been created that allow the training of specialists for new, growing areas of science and technology. Up to 500 students annually undergo production practice in institutes of the UkSSR Academy of Sciences.

As for creative scientific relationships between union-republic academies of sciences and VUZ's, it should be noted that, although such relationships have achieved a rather high level (UkSSR, BSSR, LaSSR, LiSSR, MSSR, and others), they cannot be called satisfactory as a whole. VUZ's of union republics are still not sufficiently enlisted in active participation in the scientific research process of republic academies, and the capabilities of VUZ's, their intellectual and scientific-technical potential is insufficiently utilized. Insufficient also is the interaction between scientific problem councils of the academies of sciences and the corresponding VUZ departments. Scientists of the academies of sciences do not participate actively enough in the scientific research of VUZ's, especially on those problems for which VUZ's are the head organizations. The right forms have not been set up for the cooperation of libraries, patent services, and scientific-technical information between union-republic academies and VUZ's. Academy-VUZ joint research related to fulfillment of special-purpose complex programs is still rare in the republics; insufficient also is cooperation on specific developments between departments of higher schools and corresponding scientific institutions of their republic academies, and also coordination in planning and conducting joint topical conferences and symposia.

The improvement of creative and practical relationships between academy institutes and republic VUZ's and raising the level of research conducted by them also require the unification of their efforts to develop collective utilization of expensive and unique equipment, and, in this connection, systems for acquiring this equipment without unnecessary duplication.

Thus, in summary, it must again be stated that the expansion, deepening, and improvement in the creative relationships between republic academies and higher schools are extremely urgent at the present time, since they represent a powerful hidden reserve that we should utilize to increase the effectiveness of science under the 11th Five-Year Plan and to accomplish the tasks placed before science by the 26th CPSU Congress.

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CSO: 1814/48

NEW EDITION OF 'MULTILATERAL COOPERATION OF THE ACADEMIES OF SCIENCES OF THE SOCIALIST COUNTRIES' ISSUED

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 4, Apr 82 pp 112-115

[Review by S. G. Kara-Murza, candidate of chemical sciences, of book "Mnogostoroneye sotrudnichestvo akademiy nauk sotsialisticheskikh stran"[Multilateral Cooperation of the Academies of Sciences of the Socialist Countries], collection of articles and documents edited by Academician G. K. Skryabin, Moscow, Izdatel'svto "Nauka," 1981, 2000 copies, 368 pages]

[Text] The strategic principle of a coordinated scientific policy of the socialist countries to guarantee a solid front of research in all directions of scientific and technical progress has become urgent as never before in the recently developed international situation. A task of this scale can only be solved by the joint efforts of the states, and therefore requires all possible activation of scientific cooperation among the countries of socialist cooperation. This also determined the interest of the researchers, workers of the adminstration and broad circles of scientific public in works treating methodological and organizational problems of scientific cooperation which generalize the accumulated experience.

The Administration of Scientific Cooperation with the Socialist Countries of the Presidium of the USSR Academy of Sciences and the Institute of the History of Natural Science and Technology of the USSR Academy of Sciences recently prepared a second, considerably revised and supplemented edition of a collection of articles and documents "Multilateral Cooperation of the Academies of Sciences of the Socialist Countries" (first edition in 1978). The need for the revision was explained by the fact that in the last 3 years, the ties between the academies have significantly deepened. New agreements were concluded, the circle of their participants was expanded and the Program for Multilateral Cooperation of the Academies of Sciences for 1981-1985 and the draft of the Long-Term Program for Multilateral Cooperation in the Area of Natural Sciences to 1990 were approved.

By tradition, the main fund for basic research in the socialist countries goes to the academies of sciences, and the ties between them essentially determine the condition of cooperation in the sphere of basic sciences. These ties are an organic part of the entire system of international scientific and technical cooperation in the framework of socialist cooperation, and at the same time, they reflect the specific nature of the academies of sciences as a special form of organization of science.

The circle of questions touched upon in the collection is very broad: the principles for development of science and the scientific cooperation under socialism, the history of cooperation of the academies, extensive information about the exchange and mutual help in specific scientific areas. We find rich factual material in the documents which show the real practice of organizing multilateral scientific cooperation based on the use of a developed complex of original methods and resources. This material which is diverse in its nature was successfully united into a comparatively small book and it was successfully presented in a compact form because of the well-thought out structure of the collection.

The first section presents the text of the speech of L. I. Brezhnev at a meeting with the leaders of the academies of sciences of the socialist countries on 17 February 1977, where the modern concepts regarding the role of science in the socialist and communist construction, and the tasks and principles of scientific cooperation of the socialist countries which are the basis for Soviet scientific policy were formulated. The basic statutes of the Communique on the Conference of Presidents of the Acadmies of Sciences of the Socialist Countries (15-18 February 1977) presented here are in common with these concepts.

The next section is articles which cover the specific areas of multilateral cooperation of the academies and development of its organizational forms. The authors of a number of materials are major Soviet scientists who have participated in the establishment and the deepening of cooperation. It is apparent from their stories how the formation of the scientific ties occurred, how the selection of the organizational forms was influenced by the cognitive situation in a certain trend of research or in a discipline, the presence of a scientific stockpile, condition of the infrastructure of research of the partners, how the initiative and potentialities were considered not only of individual scientific schools, but even the individual prominent researchers. In fact, even with a unit of that organizational-legal basis on which international scientific and technical cooperation is built among socialist countries, each specific international community of scientists which developed in a specific area of science is an unrepeatable social organism. The description of the history of formation and development of these communities is successfully supplemented by documents collected in the third section regarding the multilateral cooperation of the academies. The publication of these documents is of scientific-cognitive importance, and in the context of the book, the indifferent articles of the agreements and the charters acquire a new sound: they convincingly show the fraternal and equal-rights nature of the relationships between the partners in the area of scientific cooperation based on socialist principles of international solidarity. This is the great merit of the collection.

Comparison of the facts of specific history of cooperation of the academies of sciences of the socialist countries with organizational-legal documents generates interesting methodological questions. The long-established concepts acquire new content, especially the concept of mutually advantageous cooperation. It is known that from the very beginning of multilateral cooperation in the sphere of basic research, the USSR Academy of Sciences has made such investments of material-technical and cadre resources to the common business that they have become a systems-forming factor which creates the basis for further joint activity. Of great importance, for example, was the transfer of a first-class experimental base to the United Institute of Nuclear Research. This made it possible in short periods to guarantee a high level of research in nuclear physics and elementary particles, and for the scientists of all the socialist countries offered the possibility of participating in the development ofone of the most important trends in scientific and technical progress. The technical resources presented by the Soviet Union permitted cooperation in another sphere of science, space research.

The countries who are participating in the program "Intercosmos" do not make mutual payments and calculations. The USSR is offering gratuitous resources of space rocket equipment and services of the command and measuring complex to its partners in cooperation. The USSR Academy of Sciences takes upon itself comprehensive testing of the satellites with the apparatus of the interested organizations and conducts preliminary processing of the telemetering information from on board the satellites. It is then sent for analysis to the countries participating in the experiment. Intensified work to study space has joined the large international collective of scientists, engineers, cosmonauts and workers. The effect of each joint experiment is not limited to the "scientific advantage" of each of the participants, but creates a common, indivisible value. When the satellite "Intercosmos-Copernicus-500" was put into orbit in honor of the 500th anniversary of N. Copernicus with scientific apparatus developed by the Polish scientists, the entire socialist community expressed its respect for the great scientist. There is also an immeasurable effect from the manned flights of citizens of the socialist countries in international crews on Soviet spacecraft and stations which was suggested by the USSR.

The organization of international cooperation in nuclear and space research, which, as is known is distinguished by great specificity associated with the unique technical base, is sufficiently completely covered in the collection. In addition, the history and current state of cooperation of the academies of sciences of the socialist countries are shown in a broad spectrum of disciplines and scientific trends that are not strictly tied to the unique and expensive equipment.

The book reports on the different "centers of crystallization" which developed as a result of the unification of scientists of different fields of science, the mutually supplementing combination of efforts of different scientific schools, and the coordinated study of the object with the help of different approaches. An eloquent example of this, molecular biology, is an area where because of the successful harmony of the joint efforts of a very large number of scientific institutions of many countries, significant results have been achieved in a short time. They are determined a great deal by the extensive scientific-organizational experience accumulated from the moment that the international problem commission "Chemistry and Biochemistry of Nucleic Acids" was set up in 1962, the authority it has won in the scientific community, and the convincing demonstration of efficiency of multilateral cooperation.

The problem commission for the comprehensive problem "Molecular Biology" was set up in 1975. Now there are 30 institutes of the USSR and about 70 scientific institutions of the socialist countries participating in multilateral cooperation coordinated by this commission. They are jointly working out over 20 topics.

The project "Revertase" (leaders of the work Academician V. A. Engel'gardt and Doctor of biological sciences L. L. Kiselev) indicates the enormous potentialities which have been afforded during the joint studies. The main purpose of the project is to master synthesis of the genetic material by the so-called reverse transcription (synthesis of DNA on the RNA matrix by the revertase enzyme). Studies on the project expand the concept regarding the basic features of living systems, and at the same time afford new paths for work in the field of genetic engineering which have great applied importance for medicine and agriculture.

A large number of organizations of the Third World countries participated in implementing the project. The administerial experience indicates that in order to coordinate such a complicated system, strong administrative and economic levers are needed, however the project "Revertase" was implemented without the creation of any supranational agency which possessed such levers. Common interest, mutual confidence of the participants and high scientific authority of the leaders proved to be sufficient factors to guarantee close cooperation, and in compressed schedules implemented a major scientific and technical program. The group of scientists led by Academician V. A. Engel'gardt was awarded the USSR State Prize for this in 1970. Among the laureates were Academician of the Czechoslovakian Academy of Sciences I. Rzhiman and Academician of the GDR Academy of Sciences Z. Rosenthal.

The cooperation of the academies of sciences of the socialist countries for basic scientific problems implemented within the framework of the problem commissions is supplemented by work done under the aegis of the coordination centers. These centers coordinate the efforts on an interdepartmental basis and unite different stages of the scientific and technical cycle, from forecasting to experimental-design developments. In recent years the functions of the coordination center have been place more on the academic institutions. In particular, the Institute of Biophysics of the USSR Academy of Sciences coordinates the research in the area of biological physics of 137 organization-executors from the socialist countries. The collection demonstrates well the combination of the most important forms of organizing the cooperation in academic science and the methods of including this cooperation into the general system which unifies the institutions and organizations of all types.

A lot of space in the collection is given over to the area of social sciences. The features of these studies, the continuity of basic knowledge and its direct use in controlling social processes, political-educational work and the ideological struggle, and the need for a fast response to the urgent questions which the complicated and rapidly changing political situation in the world raise--all of this has governed the special forms of coordinating the cooperation of social scientists. The collection covers the role and the activity of the permanent management agency, the Conference of Vice-Presidents of the Academies of Sciences of the Socialist Countries for Social Sciences from the moment of its signing in 1971 of the Agreement on Multilateral Scientific

Cooperation. Retrospective analysis of this cooperation shows a trend towards increase in it of the specific weight of the major "monograph" studies. This has been organizationally reflected in the transition to the five-year planning and the adoption of long-term programs which unite a number of target programs. They have been developed by international research groups set up on a temporary basis.

Major joint measures are also being taken in the sphere of setting up scientific-information servicing of the scientists. A special article in the collection covers an analysis of the joint efforts of the socialist countries to set up the International Information System for Social Sciences (MISON). The Institute of Scientific Information for Social Sciences of the USSR Academy of Sciences has become the leading agency in the MISON.

On the whole, familiarity with the collection makes it possible to conclude that its authors and editors did extensive and useful work. It only remains to be hoped that this book has opened up a whole series of works on the problem of the cooperation of socialist countries in the area of fundamental science at the current stage which is urgent in a practical and theoretical sense.

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S&T POLICY BEING EMPHASIZED IN CEMA COUNTRIES

Moscow VOPROSY EKONOMIKI in Russian No 12, Dec 81 pp 83-92

[Article by G. Vlaskin, Yu. Naido and O. Yurygin: "Trends of Scientific-Technical Policy in CEMA Countries (Survey)"]

[Text] In the transition to intensive type of economic development, scientific-technical policy begins to play a larger role in the economic policy of the socialist countries. The measures taken in the framework of scientific-technical policy for state power and control are aimed at:

selection of ways for optimal development of national scientific-technical potentials (financing of scientific research and experimental design developments, SREDW, their structure, formation of the cadre potential of science and its staff, strengthening of the material-technical base of science);

accelerated introduction of results of scientific research and development into the national economy and their maximum dissemination (improvement in planning, control and economic stimulation of scientific and technical progress, STP, questions of organizational and economic unification of science and production, etc.);

improvement in the efficiency of the country's participation in the international separation of labor in the area of science and technology (scientific-technical cooperation, STC, of the socialist countries among themselves, with the developed capitalist and with the developing countries).

Financing of SREDW is viewed in the CEMA countries as the most important condition for expanding the scale and intensifying scientific research and development, increasing capital investments to the material and technical base of science, acquisition of foreign licenses, etc. In the 1960's-1970's, the growth rates for expenditures for science and technology considerably outstripped the growth rates for the national income. As a result, in the countries of socialist cooperation there was a continuous rise in the percentage of expenditures for SREDW in the national income. In the second half of the 1970's, the indicated percentage for the European countries of the CEMA (minus Romania) was in limits from 2.2 to 4.6%, and in the Socialist Republic of Romania, 1.35%. This means that for this indicator, the socialist states currently occupy the leading place in the world. This refers in the first place to the USSR, CSSR and GDR. The expenses for SREDW in all the CEMA countries reached an impressive amount, about R 40 billion. [1]

In the last 20 years, the CEMA countries have focused a lot of attention on the formation of cadre potential for science. Now the total number of those involved in the sphere of science and scientific servicing has already exceeded 5 million people, of them 1.6 million are scientific workers. Roughly 80% of the total potential of scientific cadres in the CEMA countries is in the USSR (4.35 million people). The CEMA countries now occupy one of the leading positions in the world for this indicator as well.

The process of forming the cadre potential for science in the countries of socialist cooperation was accompanied by the creation of a developed network of scientific research institutions of both academic and sector profile (currently over 10,000). The scientific workers of the higher educational institutions of the fraternal countries have also made a considerable contribution to the development of the scientific problems.

An important result of the development of scientific and technical potentials of the socialist countries was the growth of inventor activity (see table 1). In 1978, the CEMA countries recorded over 84,000 inventions, including 54,600 in the USSR. There was also a considerable growth in the effect from introducing inventions into the national economy. Thus, in 1970-1978, it increased in Bulgaria 8-fold, in the CSSR 6.6, and in the USSR 5.6-fold. The average amount of economic effect for one invention rose in the same period in Bulgaria 2.5-fold, in Czechoslovakia 2.8 and in the USSR by more than 3-fold (see table 2). On the whole, the CEMA countries considerably surpassed the countries of the EEC and the United States in the number of inventions.

Table 1. Dynamics of Patenting of Inventions in the European Countries of the CEMA

	1970	1978
People's Republic of Bulgaria	534	1,750
Hungarian People's Republic	481	1,529
GDR	5,308	5,017
Polish People's Republic	2,180	5,845
Socialist Republic of Romania	1,440	7,838
USSR	30,636	54,593
CSSR	3,224	7,550
Total	43,803	84,122

The scientific-technical policy conducted by the countries of socialist cooperation has as its goal the further development of national scientific-technical potentials. Their primary focus is high-quality improvement, increase in the output of those involved in the scientific-technical sphere. Problems associated with an improvement in the structure of the cadre scientific potential, structure of financing of the SREDW, etc. acquire especial urgency.

One of the most important questions is improving the fund- and technical-equipping of those involved in the sphere of science and scientific servicing. In the USSR, for example, in 1950-1977, the specific weight of the wages fund for the payment of labor rose roughly 10-fold with a rise in allocations for technical equipping of the scientific research institutes 50-fold.[2] There is a similar situation in the other CEMA countries. Nevertheless, the problem of improving the fund supply and the technical equipping in the sphere of SREDW continues to remain urgent and requires further change in the structure of their financing in support of an increase in the percentage of capital investments.

Table 2. Economic Effect of Introducing Inventions in Certain CEMA Countries

	1970 (in millions of the national currency)	1978 (in millions of the national currency)	1978 versus 1970 (times)	Effect on one invention: 1970 (in thousands of national currency)	Effect on one invention: 1978 (in thousands of national currency)	Effect on one invention: 1978 versus 1970 (times)
People's Republic of Bulgaria	9.8	80	8	18.3	45.7	2.5
USSR	261.8	1467	5.6	8.5	26.8	3.15
CSSR	184.1	1224	6.6	57	162	2.84

Modern STP places before industry higher requirements from the viewpoint of the technical level and quality of the manufactured product. It is obvious that satisfaction of these requirements will become impossible without integration of science and production. However, as noted at the CPSU congresses and congresses of other fraternal communist and workers' parties, in the chain connecting science and production, the weakest link is the introduction of scientific and technical achievements into industry. Consequently the general trend of the scientific-technical policy conducted by the socialist states is becoming more effective introduction at the current stage of scientific and technical achievements, and namely, this is primarily associated with the resolution of tasks of intensifying the economy of the fraternal countries.

The CEMA countries for a number of years already have been implementing a set of various economic experiments aimed at realizing this complicated, multifaceted problem. In the 1960's-1970's they accumulated rich collective experience in this area which resulted in positive shifts.

The efforts of the socialist states have been primarily focused on the convergence of science and industry. Thus, in the framework of the scientific-technical potential, a mass transition has been observed in all the countries of SREDW to cost accounting.[3] In the last two-three five-year plans in all European countries of the CEMA there has been a significant reduction in the percentage of budget financing of SREDW with a rise in the percentage of capital from the special funds of the sectors and enterprises. The transfer of the scientific research institutes to the subordination of the sectors has become widespread. Considerable attention is concentrated on the creation of an experimental base for science.[4]

In a more specific examination of the scientific-technical policy of the socialist countries it is necessary to primarily isolate the main trends to improve the planning, control and economic stimulation of STP. During the solution of these problems in individual CEMA countries a national specific nature appears which enriches the joint experience. At the same time, this specific nature primarily concerns the specific methods of realizing individual measures, while the main trends have mainly a common nature.

Planning and Control of STP

The basis for integrated control of STP in a planned economy is the agreement of a plan for development of science and technology with the other sections of the national economic plan. The transition to program-target method in which attention of the research organizations was oriented on the solution of specific scientific-technical tasks promoted the improvement in the methodology of planning STP in the socialist countries. This strengthens even more the "start-to-finish" planning in the cycle "research-production" and guarantees synchronization and mutual correlation of the processes for the development of science, technology and production at different levels. The main link in planning science and technology becomes the target integrated programs for the most important scientific-technical problems.

The plan for development of science and technology in the GDR began to include questions of introducing the results of SREDW into production in 1972, and in 1973, the section "Science and Technology" was introduced into the national economic plan for the first time. For the integrated preparation and realization of the assignments in the state plan for 1976-1980, coordination plans were compiled for this section which encompass the entire process, from research to practical use of scientific-technical results. The basic form of planning science and technology in the GDR has become the five-year plan. The annual planning is limited to assignments for the introduction of scientific-technical results into production.

In the CSSR, starting in 1973, the plan for realization of the concluded SREDW was included as a mandatory part of the national economic plan and production plans of industrial enterprises. Romania compiles detailed annual plans (schedules) for introducing SREDW results into material production. The STP is controlled in Bulgaria through a unified plan of socioeconomic development of the country. The section of this plan "Science and Technical Progress" covers the entire cycle "research-production."

The Soviet Union in the 1960's-1970's developed roughly the same general trends in planning and control of STP as in the other CEMA countries. These questions acquired especial importance because of the decree of the CPSU Central Committee and the USSR Council of Ministers on improving the economic mechanism. The basis for the formulation and the component part of the USSR national economic plan for 10 years is the integrated STP program developed by the GKNT, Gosstroy and USSR Academy of Sciences which is designed for 20 years and which is subject to revision every 5 years. As in other CEMA countries, in the Soviet Union the importance of integrated target scientific-technical programs is rising. They must conclude with the introduction of SREDW results in the optimal scales.[5]

The organizational forms of controlling STP are also being improved. They foster a strengthening of the tie between science and production and acceleration of the introduction process. The most effective form is the large associations and combines set up in the CEMA countries. They have a powerful scientific-production, cadre and material-financial base. The process of integration in one economic complex of scientific research institutes, planning offices, technological and experimental enterprises included in these complexes is continuing to evolve.

In the USSR, merging of science and production in the form of scientific-production associations has become the most popular. These associations began to be set up in 1969. There are currently about 200 of them, and in the next 2-3 years, according to estimates, there is the possibility of setting up another 200-250 associations of this type. The Institute of Electric Arc Welding imeni Ye. O. Paton of the UkSSR Academy of Sciences has verified and confirmed the high efficiency of the new form of organizing research, academic scientific-technical associations which include institutes, large design offices, experimental production and experimental plants. The USSR is also testing other forms of combining science and production, for example, complexes of design offices and scientific-technical institutions of double subordination (ministries and departments solve organizational-financial questions, while the academic institutes provide the scientific supervision), educational-scientific-production associations, territorial scientific-production associations, etc.

The most popular form of combining science and industry in the GDR is the combines. There are currently 129 of them. The GDR also has interesting experience of creating within the framework of the Academy of Sciences a "potential of introduction" which includes facilities for the production of scientific apparatus and experimental plants. There are organizations of this type in one-third of the institutes of a natural-science profile, and in the next 5-10 years, it is planned to set them up in another one-third of the scientific research institutes.[6]

Other CEMA countries have accumulated fairly diverse and useful experience on solving problems of combining science and production. Despite the specific nature of these countries, it is common that in all countries, the scientific research, planning design and technological organizations which are included in the associations are directly involved in the sphere of material production.

Economic Stimulation of STP

In the socialist countries, the questions of planning and control of STP are viewed together with economic stimulation. This problem has not yet been properly resolved. However, a broad and intensive economic search is underway which has already been crowned with many positive results. This problem is being resolved in the CEMA countries from the viewpoint of economic stimulation both of science and production.

As for science, the transition of scientific research organizations to the contract form of fulfilling work played an important role here. This form is being developed especially intensively between the scientific-research institutions and the enterprises that are organizationally separate.

In terms of economic stimulation of production, in addition to the funds for development which have primarily an investment nature, the associations and enterprises of the socialist countries have set up special funds for technical development (new equipment). Although the methods of forming these funds is not the same in different socialist countries, their general economic function consists of compensating for the increased outlays during the development, mastery and introduction of new equipment and technology into production. In addition, these funds finance SREDW associated with new equipment.

The most important means of stimulating STP in all countries of socialist cooperation is improvement in price formation. Using prices, the development of technically more improved products, removal from production of outdated items, compensation for outlays for improving quality and the technical level of the manufactured products are encouraged. The main task of price formation is to guarantee the interest of the producers in the output of leading equipment and the consumers in using it.

The trends noted here and the new aspects of planning, control and economic stimulation of STP in the CEMA countries far from completely reflect the diversity of the practical measures in this area. At the same time, they indicate that the scientific-technical policy of the socialist countries is constantly being developed and improved and promotes the subordination of the internal resources of the countries to the resolution of tasks for reconstruction of the structure of production in accordance with the requirements of STP.

At the same time, one of the most important trends in the modern scientific and technical policy of the socialist states, as previously noted, is the improvement in efficiency and degree of participation of the country in the international division of labor in the area of science and technology. The modern structure of production in the CEMA countries is characterized by a very broad range. For example, Czechoslovakia which produces 70-80% of the world nomenclature of machines and equipment, has only 1% of the world scientific-technical potential. This significantly complicates the task of maintaining a high technical level for the entire range of nomenclature of the manufactured products. The most important condition for the growth in rates of STP for the socialist countries is the conducting of a selective production policy with simultaneous increase in the degree of participation in international division of labor. Complete utilization of its advantages in the sphere of science and technology will improve the efficiency of the total scientific-technical potential of the CEMA countries as a whole by roughly 30%, and in certain socialist states several times. The international factors of intensifying the economy of the socialist states in their potentialities are no longer merely comparable to the national, but in a number of cases even surpass them. Consequently, under modern conditions, the role of the "foreign" aspect of scientific-technical policy is immeasurably rising.

In the last 10 years, the volume of joint SREDW in the CEMA countries has risen 5-6-fold. Over 3,000 scientific research and planning design organizations, VUZ's, including about 200 scientific institutions of the academies of sciences of the countries of cooperation participate in them on a multilateral and bilateral basis.

The development of STC of the CEMA countries is accompanied by qualitative changes. Whereas in the 1950's-1960's the leading form of STC was free exchange of technical documents and experience, subsequently intensification of STC occurred through the transition to multilateral and bilateral coordination of research, contract cooperation, joint research and exchange of the results of scientific research with the use of elements of cost accounting. The holding of mutual consultations by the CEMA countries on the main questions of scientific-technical policy in order to determine problems for the current five-year period, development and agreement of plans of multilateral and bilateral cooperation has firmly entered the practice of cooperation.

New forms in the development of STC were: the formulation of a coordinated plan of multilateral integrated measures, including in the area of science and technology for 1976-1980, where 600 million transfer rubles were invested; compilation of plans for the long-range future (several five-year plans) in the framework of DTsPS [expansion unknown]; transition from the sector principle to comprehensive resolution of the major tasks of STP (STC program for environmental protection and efficient use of natural resources, program to solve fuel and energy problems, etc.); development of direct ties between the ministries and departments of the CEMA countries, among whom about 400 agreements and contracts for STC have been concluded.

About 3000 scientific research institutes and planning design organizations and VUZ's participate in measures for the fulfillment of the comprehensive program for integration, and about 200 academic scientific institutions and 1600 organizations cooperate on 800 topics on a multilateral basis. About 4,000 problems and topics are being worked out on a bilateral basis.[8]

An important trend in the development of scientific-technical ties is the international cooperation in the area of standardization. Fifteen sector permanent commissions of the CEMA and 11 international organizations of the cooperating countries participate in the standardization work. A total of 2724 standards of the CEMA have currently been approved.[9]

The cooperation of the socialist countries in the area of science and technology made it possible to solve a number of major national economic problems. The CEMA countries have attained considerable success in the area of power engineering. Thus, the unit power of electric generators in these countries rose in the last 20 years 5-8-fold, and today they have blocks with power of 500 MW. The USSR has made the world's largest turbo-unit with power of 1200 MW and is designing one with power of 1500 MW. For specific consumption of fuel for the generation of electricity, the last 10-15 years have been characterized by a trend for its rapid decrease. The USSR and other CEMA countries are on the level of a number of leading capitalist countries for this indicator, and even outstrip them.

The CEMA countries occupy one of the first places in the world for the transmission of large quantities of energy superlong distances. The USSR was the pioneer in the area of ultrahigh-voltage power transmission lines, and now power transmission lines are being built here for 1500 kV for distances of

2400 and 5300 km which are unprecedented in world practice and power transmission lines are being designed fro 2000 kV. Based on the unified energy system and the central dispatcher control of the CEMA countries, a ring power system has been set up which is unique in the world. It unites 21 power transmission lines (PTL) with voltage from 220 to 400 kV. The introduction of the PTL Vinnitsa-Al'bertish with voltage of 750 kV which is the largest in Europe will liberate the CEMA countries from building additional power plants with total power of almost 2000 MW.

In the area of superhigh-voltage equipment, progressive developments have appeared in recent years: for the first time in the world, high-voltage thyristor valves were used for the PTL transformer stations of superhigh-voltage, and an original laser system of control and regulation was made.

The CEMA countries occupy leading positions for a whole series of trends in the realization of alternative and nontraditional energy sources. Here they are making joint studies to create and develop power units with water-cooled reactors with power of 1000 MW, breeder reactors on fast neutrons (the USSR operates the world's largest reactor of this type). The Soviet Union is also building the world's largest uranium-graphite channel reactor for 1500 MW and plans for 2400 MW. Among the prominent achievements in this area, one should include the creation of the world's first unit of the type "Tokamak" with superconducting magnetic system and the world's largest MHD-generator for open type power plants (this is the world's only industrial MHD-unit).

A great step forward has been taken on a collective basis in the area of electrical technology. For the first time in the world, the specialists of the USSR and GDR have made a plasma furnace with capacity of 30 T for smelting high-alloy steel, in which a temperature of 15,000 °C is reached. This made it possible to bring the degree of assimilation of the alloyed elements almost to 100%. As one of the last successful joint developments, one should name the unified semiautomatic unit "Intermigmag" for arc welding by melting electrode in a medium of protective gases that was made by the specialists of the Socialist Republic of Bulgaria, GDR and USSR. One should also make mention of the units of electron-beam welding "Paton-tsis/77" that were developed jointly by the CEMA countries. The CEMA countries are responsible for roughly one-third of the total world flow of scientific-technical information on questions of welding science, equipment and production.

One can name a whole series of examples where, by uniting their efforts on an integration basis, the CEMA countries were able to solve the most complicated national economic tasks. Thus, the method they created for obtaining high pressure polyethylene "Polimir" exceeds the best technological processes abroad,and the largest chemical concern in the FRG "Zaltsgitter", having bought a license for it, even now proposes organizing the marketing of the appropriate technology in the Third World countries.[10]

Considerable advances have been made by the CEMA countries in the area of metallurgy. It is enough to name if only those universally recognized, basically new technologies as casting with counter pressure and technology of shiny copper plating (People's Republic of Bulgaria), the technology for producing forged crankshafts (Polish People's Republic), evaporation cooling of blast furnaces, production of multilayer pipes for gas pipelines, production of tungsten-free solid alloys (USSR).

The unification of scientific and technical potentials of the countries in the area of computers was very important. According to expert estimates, in 5-6 years years, advances were made here which are equivalent to the previous activity in countries in 25 years. An intergovernmental agreement united the potential of 300 enterprises and 350,000 employees. As a result, the percentage of jointly developed computer equipment in the total computer stock of the CEMA countries rapidly rose: in the CSSR, for example, in 1971-1975, 440 computers entered the national economy (of them 160, that is 36%, from the "Ryad" system), and in 1976-1980, 880 computers 880 computers (of them 750 of the system "Ryad" that is, already 85%).

Prominent results were obtained in certain areas of basic research, among which research on the program "Intercosmos" occupied an important place. The CEMA countries occupy leading positions in the world in the area of synthesis of drugs and antibiotics, and the formulation of theoretical fundamentals for gene engineering.

At the same time, in recognizing the undoubted advances in the development of STC of the CEMA countries and strengthening of their scientific-technical potentials, it should be stated that the reserves of international division of labor in science and technology are still not being completely utilized. The main content of cooperation of our countries is still the resolution of a certain problem according to the development of a new design, and the introduction and assimilation of results of joint research and development are done at the discretion of each cooperating party. At the same time, cooperation at the concluding stages of the cycle "science-technology-production-marketing" exactly makes it possible to realize the necessary effect of joint scientific and technical developments. According to the available estimates, already in the 1980's, the ratio of outlays for SREDW and introduction will change from 1:10 at present to 1:12, and even 1:15, that is, the percentage of costs for SREDW in the total volume of expenditures for scientific research, development and introduction will not be 10% as occurs now, but 6-8% with an increase in costs for introduction from 90% to 92-94%. Consequently, today, and the more so in the future, cooperation of the CEMA countries not on individual stages of the cycle "science-technology-production-marketing" will become promising from the viewpoint of the national economic effect, but for the entire cycle with emphasis on the last stage, on the condition of a comprehensive approach to this problem. It is precisely for this reason that in CEMA countries there is a clearer trend towards concluding comprehensive agreements in which questions of STC are closely linked to questions of international specialization and cooperation of production. As indicated by a whole series of positive examples, international division of labor which begins from the stage of joint SREDW with the creation of new types of machines and equipment, and concludes with the joint development of production and post-sale servicing of this equipment, permits each country to reduce by 50-70% the expenses that it would carry alone, and results in the reduction in the periods for development from 6-7 to 3 years. In this case if the line for effective international separation of labor, started at the stage of creating the equipment finds the appropriate continuation in production in the form of a well-thought out system of specialization and cooperation, then labor productivity can be improved 3-5-fold, series production 6-8-fold, and the net cost reduced by 30-50%.[11]

Within the CEMA framework, there are currently 120 multilateral agreements in effect for international specialization and cooperation of production, including 90 in the area of machine construction, radio engineering and electronics industry, as well as over 1,000 bilateral. These agreements on the whole encompass about 10,000 types of items.

In the formation of a coordinated structure and scientific-technical policy, whose special importance for intensifying the process of reproduction in the CEMA countries was stressed at the 35th meeting of the CEMA session (July 1981), the countries of cooperation concentrate their scientific-technical potential on priority trends in scientific and production cooperation for the resolution of the most important national economic problems: automation of production processes based on the use of promising resources of computer equipment and primarily, micro- and minicomputers, development of systems of program control, creation of a unified element base; introduction of robot-manipulators and other means of mechanizing labor-intensive processes; creation of complexes of powerful equipment for the working of fuel and raw material fields and their transporting; development of machines and equipment which guarantee economical use of fuel and energy; updating of the machine construction stock by highly productive precision equipment; creation of comprehensive unified series of hydraulics and pneumatics. These general priorities in the structural and scientific-technical policy of cooperation as a whole are organically combined with the priorities of the national scientific-technical policy of each CEMA country, which, by guaranteeing its needs as a result of certain research and development through the use of the profiled potentials of other countries can thus concentrate its scientific-technical potential on a limited number of strategically important trends of STP.[12]

Within the framework of the scientific-technical policy conducted by the socialist countries, the development of STC with nonsocialist states occupies an important place.

The USSR and other socialist countries are invariably in support of expanding scientific-technical ties with the developed capitalist countries. At the end of the 1970's, over 1000 agreements were concluded between the organizations of the CEMA countries and Western firms for scientific-technical and production cooperation. Currently about 40% of all the contracts for cooperation are for license agreements and 20% are agreements on cooperation for the purpose of transferring technology.[13] At the same time, in recent years the scientific and techical exchange has become more of an independent type of cooperation.

Production cooperation is beginning to have a definite effect on the improvement in the structure of East-West trade. Thus, in machine construction, about 10% of all the trade is done on the basis of scientific-technical and production cooperation.[14]

Many modern problems generated by STP are common for all countries and require collective international efforts. In this respect, the CEMA countries have always supported the expansion and deepening of international cooperation with all countries of the world. For example, the initiative of the USSR to convene all-European conferences for transportation and power engineering is urgent.[15] In the future, the economy of Europe could be developed to a greater degree on the basis of mutual supplementing of the structures of individual national economies and their scientific-technical potentials, and not only on the sector, but also on the intrasector level.

Among the prerequisites for organizing cooperation among the CEMA countries and the developing countries, the primary is the mutual supplementing of the economic resources and industries available in both groups of countries. The production and scientific-technical potentials of the CEMA countries are capable of providing organization of production in the majority of sectors at the modern level. At the same time, many developing countries, possessing not only large reserves of fuel and raw materials needed by the CEMA countries, but also resources of unemployed work force and not completely utilized production facilities, still remain insufficiently developed both in an economic and scientific-technical sense (although 70% of the world's population lives in them, they have only 3-5% of all the world's expenses for SREDW and 10-15% of all the scientific workers).[16]

The objective interest of the developing states in STC with the CEMA countries is explained not only by the potentialities of the latter from the viewpoint of transferring technology. It is our opinion that those advantages which are characteristic for cooperation with CEMA countries in general are no less important. In particular, the cooperation with socialist countries promotes the the creation in the developing states of a material-technical base of independent development.[17]

According to the estimates based on U.N. publications and individual states, over 300 cooperation agreements have been concluded between the CEMA countries and developing states which stipulate the transfer of technology as a component part (they include, according to the data of UNCTAD, over 140 agreements on trilateral cooperation). In the beginning of 1980, the CEMA countries had agreements with the developing countries for construction of 4400 facilities, of which over 3,000 have been put into operation. According to the data of UNIDO, the developing countries have over 100 mixed enterprises with participation of CEMA countries.[18]

A significant contribution to the development of the economy of the developing countries is the training of national scientific-technical cadres, their education and placement in the educational institutions of the CEMA countries. Currently over 40,000 students from 100 developing countries are being trained in the VUZ's of the CEMA countries. Over 30 higher and secondary educational institutions have been built and are under construction in these states with the help of the socialist countries.[19]

One of the types of multilateral ties between the countries of different socioeconomic systems is trilateral scientific-technical and production cooperation which involve firms and enterprises from the socialist, capitalist and developing countries. According to the data of the UNCTAD Secretariat, in the middle 1970's already 53 countries had become participants in 453 trilateral projects with total cost of $29 billion (in current prices). The Soviet organizations participated in the realization of 21 projects in a certain form.[20]

Thus, the CEMA countries are actively participating in international scientific-technical cooperation. At the same time, in this area there still remain a lot of unused reserves, and they are especially great in cooperation with the developed capitalist and developing countries. However, their more complete utilization depends not only the the scientific-technical policy conducted by the socialist states, but also the good will of the other countries in the world.

FOOTNOTES

1. Recomputed according to the official rate.

2. See, V. I. Duzhenkov, "Problemy organizatsii nauki" [Problems of Organizing Science], Izdatel'stvo Nauka, 1978, p. 165; PRAVDA, 4 January 1979.

3. In the Hungarian People's Republic in 1964, in the Socialist Republic of Romania and the People's Republic of Bulgaria in 1967, the sector scientific and planning organizations were removed from the budget financing and switched to complete cost accounting.

4. In the national economy of the USSR, there are over 5,000 experimental industries in operation (Ministry of Chemical and Oil Machine Construction annually allocates about 8% of the capital investments for construction of experimental bases and experimental industries).

5. The USSR has already accumulated definite experience in the area of development and realization of scientific-technical programs. In the state plan for 1976-1980, the basic assignments were approved for programs to solve 200 of the most important scientific-technical problems, general of an intersector nature. It was planned to create about 2,000 new types of equipment of production purpose and consumer goods total for these programs, of which 60% was planned for the 10th Five-Year Plan. For the remaining objects, a stockpile was created for concluding in the next five-year plan and further (thus, in the programs for the 10th Five-Year Plan, a large volume of scientific research was provided for problems of using the principle of superconductance, creation of MHD-generators, new types of gas transportation, development of pneumatic container transportation, and protection of metal from corrosion). The development of about 1,000 new production processes, over 900 names of economical materials and about 700 automated control systems was also stipulated.

6. See, R. S. EKONOMIKA PROMYSHLENNOSTI, No 2, 1981, abstract No 2E4; PRAVDA, 23 March 1981.

7. See, VOPROSY EKONOMIKI, No 4, 1976, p 92.

8. During the realization of the comprehensive program, over 16,000 theoretical and applied works were completed, over 1600 new designs of machines, mechanisms and instruments were made, over 1200 production processes, and over 1300 types of new materials, products and preparations.

9. In the USSR, about 15% of all the GOST's [state standard] are developed with regard for the CEMA recommendations. This permitted a 10-12% reduction in outlays and 30-40% in the periods of their development. The total economic effect from introducing the CEMA recommendations into the national economy of the USSR exceeded R 750 million (see VOPROSY EKONOMIKI, No 8, 1979, pp 100, 102; EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV CEV, No 3, 1981, p 102).

10. See, PRAVDA, 28 June 1980.

11. See, "Agrarno-promyshlennaya integratsiya stran SEV" [Agrarian-Industrial Integration of CEMA Countries], Izdatel'stvo Nauka, 1976, pp 99-100; PRAVDA, 31 October 1978 and 19 March 1979.

12. For example, the CSSR in accordance with this coordinated policy for specialiaation of scientific-technical potentials could send to research on nuclear energy in the second half of the 1970's over 20% of all the capital for SREDW, while in the 1960's, it only allocated slightly more than 1% for research for all power engineering (see, EKONOMICHESKOYE SOTRUDNICHESTVO STRAN-CHLENOV SEV, no 2, 1976, p 21; "Veroffentlichungen des Osteuropa-Institutes," Munich, Reihe: Wirtschaft und Gesellschaft. Heft 14. "Forschung und Entwicklung in sozialistischen Staaten Osteuropa" von Osers, Duncker und Humblot, Berlin, 1974).

13. According to the evaluation of the experts from the U.N. ECE, 83% of all the contracts on cooperation have been concluded in scientific sectors, including 23.8% in the chemical industry (of the total number of contracts between the East and West), 22% in machine construction (including machine tool manufacture--25.5%), in the electronics and electrical engineering industry--13.5%, in transportation equipment--12.6%, in metallurgy--7.9%. Agriculture, food industry, construction, tourism and other spheres of economic activity account for 17% of the concluded agreements (ECE/Trade/R Document, 355/Add, 2, table 1; see also VOPROSY EKONOMIKI, No 6, 1977, pp 83,88).

14. See, MIROVAYA EKONOMIKA I MEZHDUNARODNYYE OTNOSHENIYA, No 3, 1979, p 102.

15. For purposes of a more efficient use of energy resources of the countries of East and West Europe and setting up of cooperation in exchange of electricity, it was acknowledged that it was necessary to set up in the framework of the World Energy Conference a working group to study the problems of unification of the power systems of these countries, that is, those problems in whose realization the CEMA countries have accumulated unique experience. The same goes for the successful resolution of ecological problems on an integrated basis.

16. See, A. N. Bykov, D. A. Lebin, "Sotsialisticheskaya integratsiya i nauchno-tekhnichekaya revolyutsiya" [Socialist Integration and the Scientific-Technical Revolution], Izdatel'stvo Nauka, 1981, pp 330, 296.

17. The main volume of help of the CEMA countries is associated with sectors of material production, and three-fourths is for industry and power engineering (see PRAVDA, 17 December 1979).

18. See, VOPROSY EKONOMIKI, No 11, 1979, pp 81-83; PRAVDA, 17 December 1979.

19. A. N. Bykov, D. A. Lebin, "Sotsialisticheskaya integratsiya i nauchno-tekhnicheskaya revolyutsiya, p 302.

20. U.N. Document, TAD/SEM, 1/2, pp 11-13.

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NEW ACADEMY OF SCIENCES MEMBERS PROFILES

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 4, Apr 82 pp 122-143

[Article: "New Members of the USSR Academy of Sciences"]

[Text] On 25 September 1981, the USSR Academy of Sciences announced the selection of active members (academicians) and corresponding-members of the USSR Academy of Sciences. For the announced and additionally isolated vacancies by the councils of scientific institutions and higher educational institutions, state and public organizations, active members and corresponding members of the academies of sciences, the USSR Academy of Sciences advanced and recorded 183 candidates for active members (academicians) and 909 candidates for correspondinb members of the USSR Academy of Sciences.

At the general meeting of the USSR Academy of Sciences on 28 December 1981, according to its Charter, 44 active members and 91 corresponding-members of the USSR Academy of Sciences were elected.

Active Members (Academicians) of the USSR Academy of Sciences

Department of Mathematics

Mikhail Mikhaylovich Lavrent'yev (mathematics)

He was born in 1932, and is a specialist in the area of mathematical physics, deputy director of the Computer Center of the Siberian Department of the USSR Academy of Sciences.

The results that M. M. Lavrent'yev obtained in studying incorrectly stated tasks of mathematical physics are widely known. He suggested effective numerical algorithms for solving such problems as evaluating stability for linear and nonlinear operator equations.

M. M. Lavrent'yev has obtained a number of prominent results in theh theory of multidimensional inverse problems for differential equations, including for the inverse problem of the theory of the potential. These studies afforded the possibility of creating new methods in geophysics to study the structure of the earth which have great national economic importance.

M. M. Lavrent'yev is a Lenin Prize laureate.

M. M. Lavrent'yev

V. A. Mel'nikov

N. A. Borisevich

S. P. Novikov

Yu. Ye. Nesterikhin

Vladimir Andreyevich Mel'nikov (mathematics, including applied mathematics).

He was born in 1928 and is a specialist in the field of computers.

V. A. Mel'nikov developed a device for control and a system of commands for computers in the series BESM which practically all the computer centers in our country are equipped with. The most famous is his development of the BESM-6 computer whose structure and architecture included promising solutions widely used in the creation of modern computers.

The module principle of constructing information-computer complexes realized under the supervision of V. A. Mel'nikov, his basic theoretical developments in the field of ideology of architecture and technology of computers, and the construction of operational systems and programming systems determined a great deal the current direction of the development of powerful domestic computers.

V. A. Mel'nikov is a two-time laureate of the USSR State Prize.

Sergey Petrovich Novikov (mathematics, including applied mathematics).

He was born in 1938 and is a specialist in the field of modern geometry and topology of manifolds, including the related sections of algebra, theory og dynamic systems, variational calculus and mathematical physics; he is head of the sector of the Institute of Theoretical Physics imeni L. L. Landau of the USSR Academy of Sciences.

S. P. Novikov created the method of classifying single-bond smooth manifolds and established the topological invariance of basic topological characteristics on single-bond manifolds. Together with his students, he developed algebraic methods for computing homotopic groups, as well as methods of so-called stable algebra. He created the qualitative theory of layers of codimensionality alone and proved the theorem on the existence of closed solutions of the tore type.

Involved in studies in different fields of modern mathematical physics, S. P. Novikov developed a qualitative theory of spatial-homogeneous solutions to Einstein's equations (cosmological models) around singularity (at the early stage of evolution), constructed techniques for finding period solutions to the Korteveg-de Frieze, developed the spectral theory of Shroedinger's operator in periodic fields, obtained an analog for variational calculus on the whole for multivalent functionals needed for qualitative study of the periodic orbits of a number of systems of classic and modern mathematical physics.

S. P. Novikov is a Lenin Prize laureate.

Department of General Physics and Astronomy

Nikolay Aleksandrovich Borisevich (general and applied physics).

He was born in 1923, is a specialist in the field of molecular spectroscopy and luminescence, quantum electronics and infrared technology, and is president of the Belorussian SSR Academy of Sciences.

N. A. Borisevich developed a new scientific trend, spectroscopy of free complex molecules. He constructed a statistical theory for photophysical processes in these molecules, introduced new spectral characteristics of molecules, and suggested methods for their experimental determination. He found and investigated thermally activated and laser radiation-initiated, slowed-down fluorescence of complex molecules in a gas phase, and solved the problem of antiStokes' luminescence.

In the area of intermolecular interactions in gas phase systems, he discovered the phenomenon of stabilization-labilization of electron-excited mutliple-atom molecules by outside gases which is used in spectroscopy, photochemistry and quantum electronics. N. A. Borisevich was the first to obtain generation of radiation of complex molecules in the gas phase and to develop a new type of laser with smoothly adjustable radiation frequency. Based on the study of the scattering of radiation by dispersed systems, he created cut-off, wide-band and narrow-band dispersion and dispersion-interference infrared filters which are widely used in different areas of science and technology.

N. A. Borisevich has been elected an outside member of the Czechoslovak Academy of Sciences and the Slovenian Academy of Sciences and Arts. He is a Hero of Socialist Labor, laureate of the Lenin Prize and the USSR State Prize, member of the Belorussian Communist Party Central Committee and deputy of the USSR Supreme Soviet.

Yuriy Yefremovich Nesterikhin (physics).

He was born in 1930 and is a specialist in the area of experimental physics, physics of plasma and automation of scientific research. He is the director of the Institute of Automatics and Electrometry of the Siberian Department of the USSR Academy of Sciences.

His research was the basis for a number of effective methods for diagnosing plasma. Jointly with R. Z. Sagdeyev, he found and studied "noncolliding" shock waves which defined a new direction in plasma physics. With the help of the physical methods he developed, a basic change was made in the technique for studying rapidly occurring processes in space physics, gas dynamics and plasma.

Yu. Ye. Nesterikhin developed optic-electronic and laser systems which are used in physical experiments. He has major achievements in the development of structural methods of integrating resources of computer equipment in the construction of automated experimental complexes. Under his supervision, and based on KAMAK, standard problem-oriented systems were created both for scientific research and for the needs of the national economy.

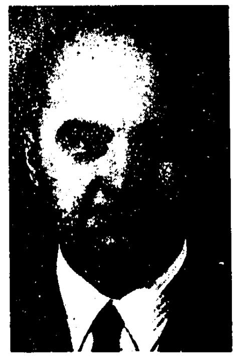
Among the works of Yu. Ye. Nesterikhin are study of the problem of the development of hydrodynamic turbulence, discovery of the photogalvanic effect in crystals, light-induced drift of atoms and molecules, and selective photomodification of biological molecules

Yuriy Andreyevich Osip'yan (general and applied physics, including astronomy, radio astronomy and astrophysics).

He was born in 1931, and is a specialist in the area of solid state physics, in particular the physics of dislocations, and is the director of solid state physics of the USSR Academy of Sciences.

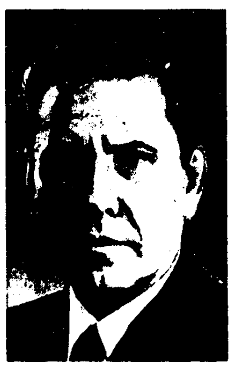
Yu. A. Osi'yan theoretically studied the effect of quantum effects on the kinetics of nondiffusion phase conversions at low temperatures. The experiments he conducted to study the mechanical properties of filiform monocrystals indicated that their real strength approaches the theoretically computed values. Heading the development of a new basic scientific direction in solid state physics, the study of the interaction of dislocations and electrons in crystals,

Yu. A. Osip'yan



A. M. Baldin

G. T. Zatsepin



V. V. Sobolev

O. K. Antonov

R. A. Belyakov

he discovered and studied the effect of the significant effect of light on plastic deformation of semiconductors which he called the photoplastic effect. He further found the reversible effect of an electric field on plastic deformation of semiconductors, as well as the development of an electric current during their plastic deformation. In experiments to study the effect of disolocations on electric properties of semiconductors, Yu. A. Osip'yan discovered the specific electrical conductivity along dislocations, as well as inversion of the type of conductance with the introduction of dislocations of varying polarity which is very important for technology. He experimentally found and comprehensively studied electronic resonance on dislocations in semiconductors, as well as the effect of dislocations on optical properties of semiconductors.

Viktor Viktorovich Sobolev (general and applied physics, including astronomy, radio astronomy, astrophysics).

He was born in 1915, is a specialist in the area of theoretical astrophysics and is the head of the department of Leningrad University.

In studying the physics of gas nebulas and stars with shells, V. V. Sobolev proposed a method for determining the temperature of the nebulas and clarified the role of light pressure in their dynamics. He created the theory of luminescence of a moving medium, providing the basis for interpreting spectra with emission lines. He formulated the theory of nonstationary field of radiation and applied it to an explanation of the phenomena occurring in flares of novas and supernovas.

He created new methods in the theory of radiation transfer which mad it possible to solve many important astrophysical problems. He explained the formation of spectral lines in the redistribution of radiation by frequency (development of this work by Soviet and foreign astrophysics resulted in the construction of the modern theory of stellar spectra). He solved the problem of multiple scattering of polarized radiation. He developed a general theory for anisotropic scattering of light and applied it to the optics of planetary atmospheres and optics of water basins. The methods he proposed are widely used not only in astrophysics, but also geophysics and other areas of physics.

Department of Nuclear Physics

Aleksandr Mikhaylovich Baldin (nuclear physics, including applied).

He was born in 1926, is a specialist in the area of nuclear physics, high energy physics, elementary particles, and accelerators, and is the director of the high energy laboratory of the Unified Institute of Nuclear Research.

A. M. Baldin created the method of envelopes, the theory of almost periodic movement of charges in random magnetic fields. He participated in the physical substantiation for the technical project of the Dubno synchrophasotron. Under his supervision, the synchrophasotron was transformed into the first and world's largest accelerator of relativistic nuclei. He developed a program and technology for creating superconducting synchrotrons.

A. M. Baldin constructed the theory and predicted all the main laws governing near-threshold photoproduction of pions, studied coherent photoproduction of mesons. The work of A. M. Baldin jointly with colleagues of the Physics Institute imeni P. N. Lebedev was the basis for the development in our country of the physics of electromagnetic interactions of adrons. He and his colleagues have two discoveries: electric and magnetic polarizability of elementary particles and direct transition of the photon-vector meson.

Among the scientific achievements of A. M. Baldin are the development of the theory of tensor electric polarizability of nuclei, prediction of the optical anisotropy of atomic nuclei, discovery of a new direction in high energy physics, relativistic nuclear physics. He predicted, and together with his colleagues discovered the cumulative effect of the formation of particles, revealed and studied a number of universal laws governing the extreme behavior of nuclear matter, manifestations of multiquark states and quark plasma.

A. M. Baldin is a USSR State Prize laureate.

Georgiy Timofeyevich Zatsepin (high energy physics, physics of elementary particles).

He was born in 1917, is a specialist in the area of the phsyics of space rays (in the aspect of interactions at high energies) and neutrino astrophysics, and is the head of the department of the Institute of Nuclear Research of the USSR Academy of Sciences.

G. T. Zatsepin developed and constructed a unit which is based on a new principle for correlation detectors, and conducted a study of broad atmospheric showers (BAS). The results he obtained compiled the generally acknowledged concept of the phsyics of space rays and elementary particles. G. T. Zatsepin participated in planning major Soviet units to study BAS in Moscow State University and at the Pamir station, and later headed the conducting of experiments on the physics of mu-mesons in cosmic rays.

In the area of theory, he has the prediction of the phenomena of high-energy cut-off of the spectrum of metagalactic protons which is the basis for the modern theory of the origin of space rays of superhigh energies, new ideas in the area of neutrino astrophysics of high energies, etc. Under his supervision, experimental methods were developed for recording cosmic neutrinos of low energies, and a set of work was done associated with the construction of the Baksan Neutrino Observatory, a unique complex of underground laboratories and giant neutrino detectors.

G. T. Zatsepin is a USSR State Prize laureate.

Department of Mechanics and Control Processes

Oleg Konstaninovich Antonov (theoretical and applied mechanics, machine construction and mechanical engineering).

He was born in 1906 and is a specialist in the field of aircraft construction.

The directions of research activity of O. K. Antonov are the development of scientific fundamentals for planning medium and heavy transport airplanes, scientific principles for aerodynamic and design layout of multiwheeled chassis of high passability, methods of improving reliability and the service life of airplanes, methods of air landing of monoloads, designs of wings made of unique monolithic elements. He is the direct executor and scientific leader of a number of projects which concluded with the introduction into series production of the airplanes in the series "An."

O. K. Antonov is a Hero of Socialist Labor, Lenin Prize, USSR State Prize, Ukrainian SSR State Prize laureate, member of the Ukrainian Communist Party Central Committee and deputy of the USSR Supreme Soviet.

Rostislav Apollosovich Belyakov (theoretical and applied mechanics, machine construction and mechanical engineering).

He was born in 1919 and is a specialist in the area of airplane construction.

The scientific and technical activity of R. A. Belyakov is dedicated to the creation of new aviation complexes and airplanes of varying purpose. The studies he made are associated with the investigation of aerogas dynamics, control systems, strength, aerial strength and different systems of on-board equipment of flying vehicles, design materials and technological processes of aircraft construction.

Under the leadership of R. A. Belyakov, tasks have been solved in the area of control systems for supersonic aircraft, the creation of designs operating under high temperature conditions at great flight speeds, the use of wings with sweep changeable in flight, considerable inrease in the power-to-weight ratio and maneuverability of airplanes, and highly economical power units and effective complexes of on-board equipment have been worked out.

R. A. Belyakov is a two-time Hero of Socialist Labor, Lenin and USSR State Prize laureate and deputy of the USSR Supreme Soviet.

Georgiy Sergeyevich Byushgens (theory of control, computers).

He was born in 1916, is a specialist in the field of stability, controllability and applied aerodynamics of flight craft, first deputy head of the Central Aerohydrodynamic Institute imeni N. Ye. Zhukovskiy, head of the department of flight mechanics of the Moscow Physical and Technical Institute.

The basic directions for scientific research of G. S. Byushgens is the dynamics of jet airplanes and other flight craft, automation of control of the airplane and applied aerodynamics. He has created methods for calculating and has studied the basic structures of automated control for near-sonic and supersonic aircraft, investigated aerodynamic characteristics of stability and controllability of the jet airplane and conducted studies on the formation of its appearance. He has done work on the outlook for the development of aviation.

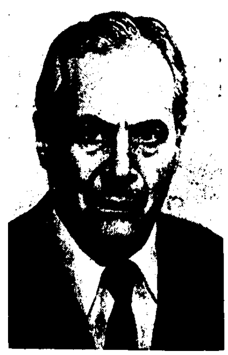
G. S. Byushgens is a Hero of Socialist Labor and Lenin Prize laureate.

G. S. Byushgens

A. D. Nadiradze

Kh. S. Bagdasar'yan

S. N. Kovalev



V. S. Pugachev

V. I. Gol'danskiy

G. G. Chernyy

Sergey Nikitich Kovalev (theoretical and applied mechanics, machine construction and mechanical engineering).

He was born in 1919 and is a specialist in the area of ship-building.

Under the supervision of S. N. Kovalev and with his direct participation, scientific research was conducted and design developments were made which concluded with the creation of ships which meet modern requirements. The creation of these ships became possible because of the solution to a number of complicated scientific-technical problems in the area of construction mechanics, general planning, propulsive performance, controllability, vulnerability, habitability, and power engineering of ships, as well as in the area of navigation and automation of basic operations.

Aleksandr Davidovich Nadiradze (theoretical and applied mechanics, machine construction and mechanical engineering).

He was born in 1914 and is a specialist in the field of applied mechanics and machine construction.

The main trend in the scientific research of A. D. Nadiradze is the mechanics of flight craft. He has developed theoretical and technical principles for constructing complicated systems of flight craft , has proposed the appropriate planning and design solutions, and has organized their collective development and introduction into the national economy. The scientific research and experimental design work of A. D. Nadiradze and the collective he heads in cooperation with other organizations represents major scientific and technical achievements.

A. D. Nadiradze is a two-time Hero of Socialist Labor and Lenin prize laureate.

Vladimir Semenovich Pugachev (theory of control, computers).

He was born in 1911, is a specialist on the theory of control, head of the laboratory of the Institute of the Problems of Control (automatics and telemechanics), and head of the department of the theory of probabilities and mathematical statistics of the Moscow Aviation Institute imeni S. Ordzhonikidze.

The sphere of scientific interests of V. S. Bugachev is the statistical theory of the processes of control, mechanics and applied mathematics. He has created the fundamentals for the statistical theory of systems which are described by differential equations, the satistical theory of linear systems and systems which lead to linear, the general theory of optimization of linear and nonlinear systems,the theory of conventional-optimal evaluation in stochastic systems. V. S. Pugachev has developed methods of studying the dynamics of controllable flight and the theory of accuracy of control of flight apparatus. The methods he has created are widely used in many fields of science and technology, in particular in the designing of systems for controlling the production processes and flight craft.

V. S. Pugachev is a two-time laureate of the USSR State Prize.

Gorimir Gorimirovich Chernyy (theoretical and applied mechanics, machine construction and mechanical engineering).

He was born in 1923, is a specialist in aerodynamics and gas dynamics, and is director of the Institute of Mechanics of the Moscow University.

In the area of aerodynamics of high velocities, G. G. Chernyy has proposed a method for integrating equations of gas dynamics which was the foundation for establishing the main qualitative laws in aerodynamics of hypersonic velocities. The generalization he made of the classic theory of the boundary layer in the case of currents when there is a surface of rupture within the layer served as the theoretical basis for solving many technical problems of gas dynamics. In the theory of detonation and combustion, G. G. Chernyy studied the asymptotic laws of dispersal of detonation waves, theoretically studied the question of stabilization of detonation waves and stationary supersonic fluxes, and experimentally confirmed the possibility of this stabilization.

G. G. Chernyy is an active memeber of the International Academy of Astronautics. He is a two-time USSR State Prize laureate.

Department of General and Technical Chemistry

Khristofor Stepanovich Bagdasar'yan (physical chemistry).

He was born in 1908, is a specialist in the field of photochemistry, radiation chemistry and kinetics of radical reactions, and is the head of the laboratory of the Scientific Research Physical-Chemical Institute imeni L. Ya. Karpov.

Kh. S. Bagdasar'yan developed experimental and theoretical methods for studying elementary stages of radical reactions. He suggested a general theory for the dependence of the rate of these reactions on the structure of the molecules and radicals. He made a very significant contribution to the theory of radical polymerization. In the area of radiation chemistry, he was the first to prove the existence of ion processes and on this basis, explained the protective action of aromatic additives against radiation destruction.

The most important achievement of the scientist in the field of photochemistry was the creation of the fundamentals for a basically new section of this discipline, two-quantum photochemistry. His laboratory proved the existence of two-quantum photochemical reactions which occur as a result of absorption of a light quantum by a molecule which has already absorbed one quantum and which is in an excited state. This results in the formation of ghighly excited molecules which enter into the reactions which are impossible in standard, one-quantum photochemistry.

Vitaliy Iosifovich Gol'danskiy (physical chemistry).

He was born in 1923, is a specialist in the field of nuclear chemistry and high energy chemistry, and is the head of the sector in the Institute of Chemical Physics of the USSR Academy of Sciences.

His works provided the beginning for nuclear chemistry as a new field of physical chemistry. He developed new nuclear and radiation methods for studying the chemical structure and properties of matter, kinetics and mechanism for chemical reactions. He made an important contribution to the development of a method for chemical gamma-resonance (Mossbauer) spectroscopy which is successfully employed in various areas of science and practice. For the first time in radiochemistry, he made a comprehensive quantitative study of the chemistry of positronium and created a method of early diagnosis of radiation damages of solid states that is a record in sensitivity.

The studies of V. I. Gol'danskiy had decisive importance for the creation of quantum kinetics of low-temperature chemical reactions. The most popular was his discovery of the quantum low-temperature limit for reaction rate, as well as the subsequent cycle of work to describe the solid phase chemical reactions as nonradiating electron transitions and analysis of the role of these reactions in the chemistry of interstellar space. He also found the phenomenon of mechanochemical explosion of irradiated mixtures of solid reagents initiated by their brittle destruction.

V. I. Gol'danskiy is chairman of the Commission on Synchrotron Radiation in the Presidium of the USSR Academy of Sciences, chairman of the Scientific Council of the USSR Academy of Sciences on High Energy Chemistry, and the chief editor of the journal KHIMIYA VYSOKIKH ENERGIY. He is a Lenin Prize laureate.

Yuriy Nikolayevich Molin (chemistry).

He was born in 1934, is a specialist in the field of chemical physics, and director of the Institute of Chemical Kinetics and Combustion of the Siberian Department of the USSR Academy of Sciences.

In the field of chemical magnetic radiospectroscopy, Yu. N. Molin developed the application of the method of electron paramagnetic resonance (EPR) to study the radical stages in the radiation-chemical reactions. The result of the large cycle of his studies was the detection of general laws governing the transfer of spin interactions in molecules, free radicals, in complexes of transitional metals, as well as the development of methods for the use of the phenomena of spin exchange for studying the elementary act of interaction of particles in solutions. He was one of the initiators of the development of work in the area of infrared laser photochemistry.

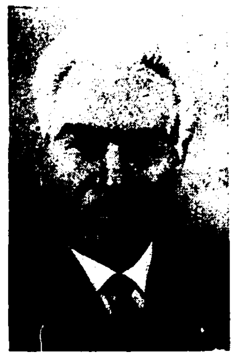
Yu. N. Molin made a fundamental contribution to the investigation of a new phenomenon, the effect of magnetic fields on chemical reactions. Together with his colleagues, he discovered the effect of an external magentic field on the reaction of free radicals in solutions and explained this phenomenon. He observed the magnetic isotope effect, and on the basis of these studies developed highly sensitive methods for recording spectra of magnetic resonance of short-lived particles in solutions.

Yu. N. Molin is the chief editor of the journal ZHURNAL STRUKTURNOY KHIMII.

Vladimir Stepanovich Shpak (technical chemistry).

He was born in 1909, is a specialist in the field of technical chemistry, and the head of the Leningrad Scientific-Technical Center for coordination of scientific research on chemistry of the USSR Ministry of the Chemical Industry,

Yu. N. Molin



V. S. Shpak

A. M. Kunayev

N. A. Vatolin

V. A. Legasov

The basic and applied studies made under the supervision and with the participation of V. S. Shpak made it possible to set up the manufacture of a number of substances, as well as to guarantee the issuing of data needed to create new equipment. The extensive study of new representatives of different classes of chemical compounds, oxidizers, elastomers, surfiactants, made it possible to isolate the most effective of them, develop the technological processes for their production and organize industrial production of these compounds.

V. S. Shpak is conducting research in the field of direct transformation of chemical energy into other types. His major success is the results of studies in the field of chemical synthesis of different amino acids. The technical solution of the task of separating optic isomers of these products afforded the possibility for industrial implementation of this process.

Department of Physical Chemistry and Technology of Inorganic Materials

Nikolay Anatol'yevich Vatolin (physical chemistry and technology of inorganic materials).

He was born in 1926, is a specialist in the field of physical chemistry of metallurgical processes, deputy chairman of the Presidium of the Ural Scientific Center of the USSR Academy of Sciences, and director of the Institute of Metallurgy of the Ural Scientific Center of the USSR Academy of Sciences.

The scientific activity of N. A. Vatolin is linked to the investigation of physical and chemical properties and the detection of the structural features of liquid metals and alloys at high temperatures in order to improve the corresponding technological processes. He has made a significant contribution to the main sections of the theory of liquid metallurgical state: model lattice theories, statistical method of correlative functions, method of pseudo-potential, and has used the method of machine modeling of this state.

N. A. Vatolin and his school made a vast cycle of experimental studies on the structure and physical-chemical properties of liquid metals and alloys based on iron, manganese, palladium, silver and silicon. His fundamental works comprised the scientific basis for creating a number of materials with assigned properties and made it possible to explain more deeply the nature of high-temperature melts.

Under the supervision of N. A. Vatolin, a series of work was done which concluded with the creation of physical-chemical fundamentals for new metallurgical processes, which include, in particular, the processes of comprehensive use of raw material in ferrous and nonferrous metallurgy, complex alloys; metallized and wustite-magnetite pellets, as well as hot leading of steel sheet were obtained.

Askar Minliakhmedovich Kunayev (physical chemistry and technology of inorganic materials)

He was born in 1929, is a specialist in the field of metallurgy of ferrous and nonferrous metals and the comprehensive use of mineral raw materials, president of the Academy of Sciences of the Kazakh SSR, and director of the Institute of Metallurgy and Enrichment of the Kazakh SSR Academy of Sciences.

A. M. Kunayev made basic research in the field of physical-chemical fundamentals of metallurgy of nonferrous and rare metals. He showed the possibility of using electrochemical methods to investigate the compounds of rare refractory metals.

Based on theoretical studies under the supervision of A. M. Kunayev, a number of highly efficient processes were created for reprocessing mineral raw material of Kazakhstan, the majority of which have been introduced into production. They include a basically new kivtsetnyy process of smelting polymetallic raw material, process of electrothermal reprocessing of intermediate products of lead production, as well as comprehensive production processes making it possible to involve the largest fields of balance ores of a number of nonferrous metals in the sphere of industrial use.

A. M. Kunayev is the chief editor of the journal of the USSR Academy of Sciences and the Kazakh SSR Academy of Sciences KOMPLEKSONOYE ISPOL'ZOVANIYE MINERAL'NOGO SYR'YA. He is a candidate for membership to the CPSU Central Committee, member of the Communist Party of Kazakhstan Central Committee, deputy of the USSR Supreme Soviet and USSR State Prize laureate.

Valeriy Alekseyevich Legasov (physical chemistry and technology of inorganic materials).

He was born in 1936, is a specialist in the field of physical, inorganic chemistry, and is deputy director of the Institute of Atomic Energy imeni I. V. Kurchatov.

The scientific activity of V. A. Legasov is tied to solution of important chemical and chemical-technological processes of nuclear power engineering. He made a fundamental contribution to the creation of the latest section of inorganic chemistry, the chemistry of rare gases. He developed industrial methods for the production of some of the compounds of these gases which have found practical application.

V. A. Legasov developed a new direction in the technology of inorganic materials which made it possible to use highly intensive atomic fluxes to produce a broad class of effective inorganic oxidizers, synthesize a number of new compounds with high molecular weight, as well as compounds of chemical elements in anomalously high degrees of oxidation.

Under his supervision, extensive studies were made in order to determine the areas of most expedient use of the sources of nuclear energy in energy-intensive sectors of industry. He studied a number of thermochemical and combined electrothermal cycles for the breakdown of water and carbon dioxide in order to study hydrogen and carbon monoxide.

V. A. Legasov is the chief editor of the journal ATOMNAYA I VODORODNAYA ENERGETIKA and the annual ATOMNO-ENERGETICHESKIYE PROTSESSY I TEKHNOLOGIYA. He is the USSR State Prize laureate.

Department of Biochemistry, Biophysics and Chemistry of Physiologically Active Compounds

Dmitriy Georgevich Knorre (chemistry of natural compounds).

He was born in 1926, is a specialist in the field of chemical kinetics, bioorganic chemistry and molecular biology, and head of the department of the Novosibirsk Institute of Organic Chemistry of the Siberian Department of the USSR Academy of Sciences.

The extensive use of spectroscopy of NMR of ^{31}P allowed D. G. Knorre and his colleagues to reveal a number of important intermediate compounds in the reactions of phosphorylation used in chemical synthesis of oligonucleotides and in the production of their derivatives, study the reactivity of these intermediate compounds, record certain side products and evaluate their effect

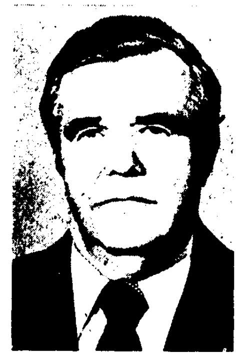
D. G. Knorre

N. P. Bekhtereva

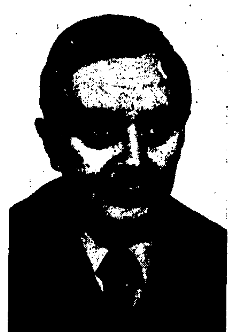
M. I. Agoshkov

I. A. Terskov

A. V. Ivanov



V. V. Rzhevskiy



L. P. Tatarinov

L. V. Tauson

on the accumulation of target products, and to outline a number of ways to overcome the side conversions. He obtained a broad set of reaction-capable derivatives of transport ribonucleic acids, oligonucleotides. He suggested a simple universal method for synthesizing derivatives of nucleoside tri-phosphates, developed the theoretical fundamentals for the kinetics of affine modification with the help of reagents forming active intermediate particles, and modified the nucleic acids within the cell. The results of work on affine modification of the most important components in the system of biosynthesis proteins-ribosomes and aminoacyl-tRNA-synthetases mades it possible, in parricular, to localize a number of sections of the ribosomes which are responsible for bonding of transport and messenger ribonucleic acids.

Under the supervision of D. G. Knorre, fundamentals were developed for the technology of producing monomers for chemical synthesis of oligonucleotides.

Ivan Aleksandrovich Terskov (biophysics).

He was born in 1918, is a specialist in the field of controllable biosynthesis and biophysics of populations, and is director of the Institute of Biophysics of the Siberian Department of the USSR Academy of Sciences.

The studies of I. A. Terskov made it possible to theoretically substantiate and experimentally implement stably functioning systems fo continuous controllable biosynthesis for populations of a varying level of complexity: single-celled algae, hydrogen bacteria, photobacteria, Protozoa, cellular cultures of tissues and organs of animals, and higher plants.

Based on the theory of control of biosynthesis developed by I. A. Terskov, experimental ecosystems of a high degree of closure were set up. A new direction is successfully developing under his supervision: biophysics of ecosystems based on the detection of exchange bonds and physical-chemical analysis of mass- and energy exchange in natural and artificial ecological systems. Methods and apparatus have been formulated for remote determination of the productivity of aquatic and ground ecosystems from mobile carriers (ship, airplane) on large territories and water areas. A number of processes have been proposed for industrial biotechnology, including chemosynthesis of feed protein which is close in composition to animal.

I. A. Terskov is the editor-in-chief of the journal IZVESTIYA SO AN SSSR. SERIYA BIOLOGICHESKIKH NAUK.

Department of Physiology'

Natal'ya Petrova Bekhtereva (human and animal physiology).

She is a specialist in the field of physiology of the human brain, and director of the Institute of Experimental Medicine of the USSR Academy of Medical Sciences.

N. P.. Bekhtereva is the author of the comprehensive method for studying the human brain. Based on experimental-clinical work, she advanced the concept of the development during chronic cerebral diseases of a stable pathological state which is maintained by definite changes in the long-term memory, and as a result of interpreting the premises and components of this state, she proposed new methods for treating cerebral diseases aimed at activation of its latent reserves, formation of new links in the cerebral systems and strengthening of its protective mechanisms.

The concept of N. P. Bekhtereva regarding the physiological foundation for the human thinking process as a dependent system of rigid and flexible neuron links made it possible to reveal the mechanisms fo reliability and optimization of work of the human brain. This is of great importance for medicine and pedagogy.

N. P. Bekhtereva is the chief editor of the journal FIZIOLOGIYA CHELOVEKA, chairman of the Scientific Council of the USSR Academy of Sciences on Problems of Applied Human Physiology and the Scientific Council of the USSR Academy of Medical Sciences on Physiology and Pathology of the Nervous System, as wll well as the Commission for Psychophysiology of the International Union of Physiological Sciences. She is a foreign member of the Austrian Academy of Sciences and has been awarded medals of Berger (GDR), McCullough (United States) and Mario Negri (Italy).

Department of General Biology

Artemiy Vasil'yevich Ivanov (zoology)

He was born in 1906, is a specialist in the field of comparative anatomy, embryology, phylogenetics and systematics of invertebrate animals, and head of the laboratory of the Zoological Institute of the USSR Academy of Sciences.

A. V. Ivanov has a number of major scientific discoveries and generalizations. He substantiated and made a detailed investigation of a new type of invertebrate for science, pogonophor, and developed the science of A. N. Severtsov on modes of procedure of evolution of organs. He revealed the laws governing the transition to parasitism (in the example of parasitic mollusks). His theoretical works regarding the origin of multicelled animals developed and reinforced the hypothesis of I. I. Mechnikov on the phagocytelle. The concept he advanced on the origin and phylogeny of flat worms provides new grounds for a resolution of the problem of the evolution of lowest invertebrates. A. V. Ivanov analyzed the organization and origin of the primitive representative of Metazoa, trichoplax. Based on the studies he made, he suggested his system of the animal world.

A. V. Ivanov is an active member of the German Academy of Naturalists "Leopol'dina."

Leonid Petrovich Tatarinov (zoology).

He was born in 1926, is a specialist in the field of zoology, paleontology and evolutionary biology, and director of the Paleontological Institute of the USSR Academy of Sciences.

The basic direction for the scientific activity of L. P. Tatarinov is research dedicated to the origin and early evolution of the largest groups of vertebrates, amphibians, reptiles, and especially mammals. Analysis of the vast paleontological and zoological material permitted him to reconstruct many previously unknown features of biological organization of the precursors of these animals, reveal the role of parallelisms in their evolution, governed not only by the similarity of adaptations, but also the common nature of the morphogenetic mechanisms of closely related forms. He examines such general questions of evolutionary theory as morphophysiological progress, monophily and polyphily, different aspects of the correlation of classification and evolution.

The paleontological work of L. P. Tatarinov is important for formulation of a stratigraphy of continental deposits of the Permian and Triassic in the Russian Platform.

L. P. Tatarinov is chairman of the Scientific Council of the USSR Academy of Sciences for the problem "Ways and Laws Governing the Historical Development of Animals and Plant Organisms," and chief editor of the PALEONTOLOGICHESKOGO ZHURNAL. He is a USSR State Prize laureate.

Department of Geology, Geophysics and Geochemistry

Mikhail Ivanovich Agoshkov (mining sciences, development of minerals).

He was born in 1905, is a specialist in the field of working mineral fields, and head of the department of the Institute of Problems of Comprehensive Development of the Depths of the USSR Academy of Sciences.

M. I. Agoshkov is the creator of the scientific school in the field of optimizing the development of ore fields. His scientific works have had a great influence on the improvement in equipment and enhancement of the economic efficiency of working ore fields, promoted a considerable improvement in the indicators for complete extraction of minerals from the depths, the creation of the scientific fundamentals for planning mining enterprises, generation of a numerical evaluation for technical and economic consequences of losses and measures to reduce them, creation of methods for national economic evaluation of the efficiency of geological exploration and the cost of estimating mineral fields. M. I. Agoshkov proposed a scientific classification of systems for working ore fields which has received general recognition.

M. I. Agoshkov is the chairman of the Scientific Council of the USSR Academy of Sciences on Problems of the Kursk Magnetic Anomaly. He is a USSR State Prize laureate.

Vladimir Vasil'yevich Rzhevskiy (mining sciences, development of minerals).

He was born in 1919, is a specialist in the field of open pits of coal, ore and nonore fields, and is head of the Moscow Mining Institute.

The basic trends in the research of V. V. Rzhevskiy are the theory of the regime of mining operations, theory of stripping working levels of quarries and freight flow of rock, theory of the systems of comprehensive mechanization of open pit mining operations, study of physical and technological processes of the mining industry and extraction of solid minerals from the bottom of seas and oceans. He has proposed the principles of the formation of mining operations, systems of working, stripping deep levels, completion of modern thick quarries with mining and transport equipment, as well as the use of physical phenomena (acoustic, physical-chemical, etc.) for intensification of the processes of mining.

Lev Vladimirovich Tauson (geophysics, geochemistry).

He was born in 1917, is a specialist in geochemistry of endogenous processes and scientific fundamentals for geochemical methods of searching for and evaluating ore fields, geochemistry of rare elements, and director of the Institute of Geochemistry imeni A. P. Vinogradov of the Siberian Department of the USSR Academy of Sciences.

The studies of L. V. Tauson treat the investigation of laws governing the geochemical history of rare elements in the processes of crystallization and differentiation of the granitoid magmas. He made an important contribution to the concepts regarding the forms of finding elements in rocks and the theory of isomorphism. He was the first to establish that the structure of a mineral is one of the main factors of the isomorphous distribution of rare elements in the processes of crystallization of magmatic melts. He created the first geochemical classification for granitoids and basaltoids and the theory of their potential ore-content, and also revealed the primary petrogenetic and metallogenetic role of potassium basaltoids (latites) which significantly expands the outlook for many regions in terms of their ore content.

Nikolay Vasil'yevich Cherskiy (mining).

He was born in 1905, is a specialist in the field of geology, exploration and working of gas and oil fields, technology of drilling and testing of wells, mechanics of the earth's crust, chairman of the Presidium of the Yakutsk branch of the Siberian Department of the USSR Academy of Sciences, and director of the Institute of Mining of the North of the Yakutsk branch.

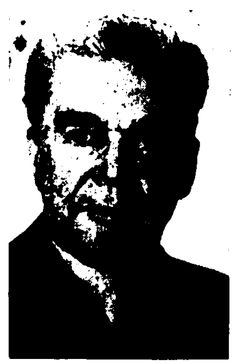
Together with other scientists, N. V. Cherskiy discovered the capacity of natural gas to be present in the earth's crust in the solid phase in the form of gas hydrates and formulated the scientific fundamentals for working gas hydrate formations which should become an important source for hydrocarbon fuel. He is one of the authors of the technique for industrial exploration and evaluation of the reserves of gas fields based on the drastic difference in physical properties of oil and gas. Jointly with other researchers, he developed basically new models for the transformation of the extracted organic matter under the influence of natural seismotectonic processes. As a result of this work, a previously unknown natural factor was revealed which determines and controls the processes of oil and gas formation. This

N. V. Cherskiy

V. I. Il'ichev

A. F. Treshnikov

V. Ye. Zuyev



P. I. Mel'nikov

A. M. Samsonov

S. L. Tikhvinskiy

supplements the theory of organic origin of oil, corrects and expands the concepts on oil and gas content of the little-studied regions.

N. V. Cherskiy is a Hero of Socialist Labor.

Department of Oceanology, Physics of the Atmosphere and Geography

Vladimir Yevseyevich Zuyev (physics of the amotphsere).

He was born in 1925, is a specialist in the field of atmospheric physics and atmopsheric optics, and director of the Institute of Atmospheric Physics of the Siberian Department of the USSR Academy of Sciences.

The basic directions in the scientific research of V. Ye. Zuyev is the dissemination of laser radiation in the atmosphere, laser spectroscopy of the atmosphere of high and superhigh resolution, laser sounding of the atmosphere. He has resolved the problem of a quantitative determination of the energy losses of laser radiation disseminated in random directions in a real atmosphere under different meteorological conditions. A characteristics feature of the work of V. Ye. Zuyev is a comprehensive approach to solving the problem of interaction of laser radiation and the atmosphere which in combination with the development of the appropriate theories and unique complexes of apparatus promoted the obtaining of important results both in basic and in applied research.

V. Ye. Zuyev is a deputy of the USSR Supreme Soviet.

Viktor Ivanovich Il'ichev (oceanology).

He was born in 1932, is a specialist in the field of oceanology, hydro-acoustics, hydrology of the sea, and director of the Pacific Ocean Oceano-logical Institute of the Far East Scientific Center of the USSR Academy of Sciences.

V. I. Il'ichev received basic results which are of primary importance for hydroacoustics, physics of acoustical and hydrodynamic cavitation, hydro-dynamics of fields of perturbations, as well as for a comprehensive study of the hydrophysical fields of the ocean. Among these results are the dis-covery of laws governing the distribution of cavitational strength of a real liquid, development of statistical theory of hydrodynamic cavitation, study of the mechanism and creation of the theory of variability in spatial-temporal and informative characteristics of acoustic fields of the ocean with the use of methods of pattern recognition, creation of models for recognition automatic machines, and modeling the phenomena on a computer.

Pavel Ivanovich Mel'nikov (geocryology).

He was born in 1908, is a specialist in the field of geocryology, and director of the Institute of Geocryology of the Siberian Department of the USSR Academy of Sciences.

The scientific interests of P. I. Mel'nikov are concentrated on questions of general and regional geocryology, groundwater in the frozen zone, geothermy, and the interaction of frozen rocks with foundations of structures. Based on these studies, he made major theoretical generalizations and isolated the laws governing the development of permafrost rocks which made it possible to introduce into the national economy of the north new advanced methods for stable construction on permafrost ground, as well as methods of searching for and operating groundwater of the frozen zone. One of the results of theoretical generalizations of P. I. Mel'nikov is the first geocryological map of the territory of the Yakutsk ASSR. As a result of analyzing geothermal conditions of the Siberian platform and the Verkhoyanskiy mountain-folded region, he discovered one of the largest positive frozen-geothermal anomalies confined to sedimentary rocks of the Predvekhoyanskiy marginal trough and the Vilyuyskiy syneclise.

P. I. Mel'nikov is the chairman of the Scientific Council of the USSR Academy of Sciences for Cryology of the Earth.

Aleksey Fedorovich Treshnikov (oceanology).

He was born in 1914, is a specialist in the field of oceanology and geography of the World Ocean, and head of the department of Leningrad University.

Under the supervision of A. F. Treshnikov, many large polar expeditions were made which brought major scientific results and discoveries. In all the expeditions, he conducted field studies, analysis of the obtained materials, and on this basis developed practical recommendations for the needs of the national economy and science. He has discovered and made a detailed study of the penetration of Pacific Ocean water into the region of the North Pole, shown the dissemination of deep Atlantic water, given their hydrobiological characteristics,as well as an evaluation of the circulation of water and its effect on the ice regime and navigational conditions of the route of the north sea passage.

Under the supervision of A. F. Treshnikov, a comprehensive program was developed "Polar Experiment" aimed at studying the interaction of the ocean and the atmosphere, and representing a component part of the international program for studying the southern ocean which is currently being implemented.

A. F. Treshnikov is the president of the Geographical Society of the USSR. He is a Hero of Socialist Labor, and USSR State Prize laureate.

Department of History

Aleksandr Mikhaylovich Samsonov (history of the USSR).

He was born in 1908, is a specialist in the area of the history of Soviet society and military history, and the senior scientific colleague of the Institute of History of the USSR Academy of Sciences.

The works of A. M. Samsonov study the problems of the history of World War II, esepcially the decisive critical stáges of the Great Patriotic War, provide a critique of the antiscientific conventions of the bourgeois authors, comprehensively show the decisive contribution of the Soviet Union and its Armed Forces to the defeat of Hitlerite Germany and imperialist Japan, cover the activity of the Soviet rear, and reveal the laws which governed the historical victory of the Soviet Army and people in the Stalingrad battle.

A. M. Samsonov is the chief editor of the journal ISTORICHESKIYE ZAPISKI.

Sergey Leonidovich Tikhvinskiy (general history).

He was born in 1918, is a specialist in historiography, source study, history of international relations in the Far East, new and latest history of China, Japan and other countries of the East, and is head of the Diplomatic Academy of the USSR Ministry of Foreign Affairs.

S. L. Tikhvinskiy is the initiator of the development of problems associated with the history of formation of the Chinese nation and ideology of nationalism, movement for reform in the Tsin empire in the early 19th century, bourgeois-democratic revolutionary movement under the leadership of Sun Yat-sen, the ideology of the national-liberation movement. S. L. Tikhvinskiy has considerable merit for his critique of the Maoist concepts of historical development of China which have been called upon to "substantiate" the great power hegemonistic course of the modern leaders of the People's Republic of China.

He made a major contribution to the study of the history of Japan, Russo-Japanese and Soviet-Japanese relations, questions of the policy of the USSR, national-liberation movement in the developing countries.

S. L. Tikhvinskiy is the chief editor of the journal NOVAYA I NOVEYSHAYA ISTORIYA, and chairman of the National Committee of Historians of the USSR.

Department of Philosopy and Law

Viktor Grigor'yevich Afanas'yev (philosophy).

He was born in 1922, is a specialist in the field of the theory of scientific communism, theory of control and methodology of systems study, and is the chief editor of the newspaper PRAVDA.

Many works of V. G. Afanas'yev have covered the problem of systems and control of a socialist society. They give special importance to the development of ways to solve the historical task set by the CPSU, unification of the achievements of the scientific-technical revolution and the advantages of socialism. The works of V. G. Afanas'yev contain an analysis of the concepts of the system, its composition, structures, functions and dynamics. They study the systems nature of the forms of knowledge, as well as the means of knowing systems. They analyze ways to improve control and in this case special attention is focused on program-target planning and control. V. G. Afanas'yev made a significant contribution to the development of problems of dialetical materialism and philosophical problems of biology.

V. G. Afanas'yev

O. T. Bogomolov

C. V. Stepanov

T. I. Oyzerman

T. I. Zaslavskaya

A. G. Mileykovskiy

V. G. Afanas'yev is a member of the CPSU Central Committee and deputy of the USSR Supreme Soviet.

Teodor Il'ich Oyzerman (philosophy).

He was born in 1914 and is a specialist in the field of the history of philosopy, dialectical materialism, general theory of the historical-philosophical process, and head of the sector of the Institute of Philosopy of the USSR Academy of Sciences.

T. I. Oyzerman has deeply analyzed the structure of historical forms of dialectics and materialism, and made a comprehensive and systematic analysis of the philosophical concept of alienation. He has made a detailed study of the basic stages in the historical establishment of the philosophy of Marxism. His works in the field of the theory of historical-philosophical process are a new trend in the research process. His numerous studies covering the teachings of Kant, Fichte and Hegel.

T. I. Oyzerman is a foreign member of the GDR Academy of Sciences.

Department of Economics

Oleg Timofeyevich Bogomolov (economics).

He was born in 1927, is a specialist in the field of problems of the development of the economics of socialism and the world socialist system, and is director of the Institute of Economics of the World Socialist System of the USSR Academy of Sciences.

O. T. Bogomolov made an important contribution to the development of theoretical and methodological fundamentals for the study of the development of the world socialist economy and socialist economic integration. Under his supervision, a number of urgent scientific directions were developed, in particular, comprehensive study of the economic, political and ideological processes in socialist countries, study of the general economic and sector problems of socialist integration, generalization of experience of the countries of socialism inthe development of socioeconomic strategy, and study of the role of socialist countries in the reconstruction of the world economic relations.

O. T. Bogomolov is the chief editor of the journal IZVESTIYA AN SSSR. SERIYA EKONOMICHESKAYA.

Tat'yana Ivanovna Zaslavskaya (economics).

She is a specialist in the field of economics and sociology of labor, and the head of the department of the Institute of Economics and Organization of Industrial Production of the Siberian Department of the USSR Academy of Sciences.

The works of T.I. Zaslavskaya treat the theoretical problems and methods of systems study and forecasting of socioeconomic processes, as well as the practical investigation of mechanisms for the distribution by labor, laws governing the migration of a population, mobility of the labor resources, development of the city and village. These works made it possible to construct a systems variant forecast for the socioeconomic development of the agrarian sector of the USSR up to the year 2000, reveal possible contradictions in the future and disproportions in a certain variant of development, and make a comparative evaluation of the efficiency of various variants. T. I. Zaslavskaya also developed methods of a typological analysis of developing social objects. Using the procedures of pattern recognition, she constructed a generalized multidimensional typology for regions of the USSR which can be used to formulate long-term forecasts for the development of the agrarian sector which are differentiated by zones of the country.

Abram Gerasimovich Mileykovskiy (economics).

He was born in 1911, and is a specialist in the field of worl economics and international relations.

The basic trends in the scientific research of A. G. Mileykovskiy is the world capitalist economy and international relations, the basic aspects of the political economy of state-monopolistic capitalism, problems of deepening in the general crisis of capitalism, critique of bourgeois economic theories, the leading trends in the development of the economy of the main capitalist powers, militarization of the economy of the capitalist countries, structural shifts, and problems of reproduction and cycles in the economics of capitalism.

A. G. Mileykovskiy is a USSR State Prize laureate.

Department of Literature and Language

Georgiy Vladimirovich Stepanov (linguistics).

He was born in 1919, is a specialist in the field of general and Roman linguistics, literary criticism, and is director of the Institute of Linguistics of the USSR Academy of Sciences.

The works of G. V. Stepanov treat urgent problems of linguistics and literary criticism, linguistic theory, history of language, sociolinguistics and stylistics, history of literature and poetics. He has developed the theory of language variance, including historical-cultural, social, structural and functional-stylistic parameters needed to characterize the forms of existence and functioning of languages, for the discovery of the laws governing their historical development. He substantiated the new solution to the problem of the systematic nature in language by introducing the concept of an external system which interacts with the internal language structure, and has proposed a new technique for describing it.

G. V. Stepanov has significantly enriched the principles for describing languages which function outside the territories of their initial dispersal, and has constructed standard models for the formation of a number of national literary languages.

G. V. Stepanov is the chief editor of the journal IZVESTIYA AN SSSR. SERIYA LITERATURY I YAZIKA. He is a foreign member of the Spanish Royal Academy and the Lisbon Academy of Sciences.

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