JPRS-UST-85-007

7 May 1985

USSR Report

SCIENCE AND TECHNOLOGY POLICY

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ORGANIZATION, PLANNING AND COORDINATION

PLANNING NEW EQUIPMENT ON BASIS OF ENTERPRISE REFERENCE MODELS

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 9, Sep 84 pp 73-78

[Article by Candidate of Economic Sciences O. Lordkipanidze, deputy director of the VNIITME [not further identified] (Tbilisi): "The Planning of New Equipment on the Basis of the Indicators of Reference Models of Enterprises"; passages rendered in all capital letters printed in boldface in source]

[Text] In conformity with the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy" the responsibility of ministries and departments for the fulfillment of the plans and assignments on the development of science and technology is increasing significantly. The accomplishment of this task is inseparably connected with the further improvement of the planning of scientific and technical progress, especially the rate and scale of introduction, which often are the weak link in the "research--production" chain.

The most important criterion of the efficiency of new equipment is the improvement of the end national economic results. But this connection is not always adjusted and effective. The main reason for such a situation lies in the fact that not the result, but the process, that is, the measures on the introduction of innovations, is planned. Planning from top to bottom according to the final indicators would mean the transition to the management of scientific and technical progress with allowance made for feedback.

Let us examine the basic directive indicators, which are planned centrally for enterprises, in the area of new equipment and technology.

THE ASSIGNMENTS ON THE DEVELOPMENT, ASSIMILATION AND INTRODUCTION OF NEW HIGHLY EFFICIENT TECHNOLOGIES are formulated on the basis of suggestions of enterprises and are for the most part individual measures, each of which, as a rule, is aimed at the solution of a specific problem for some part or operation of the technological process. A set of measures is rarely envisaged. Here it is often unclear how the end results of the activity of the enterprise change. Without the settlement of this question the anticipated economic indicators of individual measures turn out to be not equivalent to the changes of the end results of the production collective.

The fulfillment of the plans on the introduction of new technological processes often limits the possibilities of the enterprise in the increase of the output of several types of products which the national economy needs. One of the reasons for this is the fact that when formulating the plans the disproportion in the existing capacities of individual shops and sections of many enterprises and the bottlenecks are not always taken into account. The use of advanced production equipment without regard for the bottlenecks will not make it possible to increase the capacities for the output of items. At the same time such measures are frequently planned.

The increase of the volume of the output of the final product of the enterprise is taken into account in the method of determining the economic effectiveness of new equipment, but the use of this calculation for individual measures establishes the increase of production only within their limits. Nevertheless, judging from the effectiveness of individual measures, at times they infer an increase of the total volume of output of the enterprise, although in reality it at times remains unchanged.

Even in case of the implementation of measures, which are aimed at the elimination of the bottleneck of some section or shop for the increase of the production capacity as a whole, it is necessary to take into account the possibilities of its other subdivisions, which under these condition can themselves turn into bottlenecks. In other words, in the majority of cases the implementation of a set of interconnected measures is necessary for the increase of the output of the final product of the enterprise, which in practice far from always occurs.

THE BASIC INDICATORS OF THE TECHNICAL LEVEL OF PRODUCTION are also poorly connected with the end results of the activity of the collective. For example, at the enterprises of the Ministry of the Electrical Equipment Industry the level of the technology and organization of production, according to the prevailing sectorial method, is evaluated in the following manner. The base values of the technical processes and highly productive equipment, as well as the advanced methods of the organization of production, labor and management are selected. The minimum possible expenditures on the output of items are also calculated.

Such a problem was solved by the drafting of the optimum plan of the arrangement of new equipment over the entire technological cycle of the production of items on the existing areas of each of the shops.

The data on the amount of equipment, which can be placed on these areas, were used in the calculations. It also determined the maximum possible output of items, as well as the minimum possible expenditures on their production. In other words, a reference model of the enterprise, which given today's level of science and technology it is impossible to improve, was built.

The most highly productive equipment is the optimum set for each enterprise, as a result of the use of which the highest end results of its activity can be achieved. For example, at the Mikrodvigatel' Plant by means of such a set the annual output of 4AA-63 electric motors can be increased from 274,000 to 500,00, or by 1.8-fold; electric motors like the AVE-071--from 619,000 to

1 million, or by 1.6-fold. This corresponds to an annual increase of the output of commodity production from 13,066,200 rubles to 22,401,600 rubles. At the same time the expenditures pure ruble of commodity production should be reduced from 0.93 ruble to 0.76 ruble.

Let us determine the total amount of the saving, which corresponds to these indicators, and compare it with the capital outlays which are necessary for the use of the optimum set of equipment. The capital investments amount to 4,086,000 rubles, the depreciated cost of the equipment being replaced by the set amounts to 2,235,000 rubles. Consequently, the additional capital investments are equal to 1,851,000 rubles. By reducing to a comparable form the actual data on the annual output of products with the estimated data and using the indicator of the expenditures per ruble of commodity production, we will obtain the total amount of the annual saving--3,787,200 rubles, and by subtracting from it the amount of additional capital investments, which has been multiplied by the coefficient 0.15, we will determine the annual economic impact--3,509,500 rubles. Here the payback period of the additional capital investments is 0.6 year and of the total capital investments--1.1 years.

Thus, the considered example is a clear illustration of what specific end results of the activity of an enterprise can be achieved in case of the use of a set of measures on the introduction of new equipment over the entire technological cycle of the production of output, moreover, these indicators are the maximum possible ones for the given enterprise. It is possible to obtain higher results only by the creation of new capacities.

The consideration of the indicators of the reference models of enterprise in case of the planning of new equipment provides at least three basic advantages as compared with the methods being used in practice. First, a comprehensive approach to the planning of new equipment is ensured. Second, the measures being used are oriented toward the obtaining of the highest ultimate cost accounting indicators for the given works. And, third, the specific amount of required advanced equipment for all the stages of the technological process is known exactly in advanced for each enterprise, which increases significantly the efficiency of the organization of its production and distribution.

At the same time it is clear that in practice it is impracticable to plan simultaneously the introduction of the entire set of equipment, which ensures the achievement of the indicators of the reference model. The gradual accomplishment of the posed task is more advisable.

Let us examine the principles of the planning of new equipment at each stage, keeping in mind the achievement of the indicators of the reference model. First of all the comprehensive approach should be retained. Here, in addition to the use as the criterion of efficiency of the indicators of the utility of the individual measures on new equipment, which are being used today (the decrease of the labor intensiveness of production, the saving of materials in specific operations of the technological process and so on), the most important problem of the broadening of the opportunities of the enterprise for the increase of the output of its final product, which today it is practically impossible to determine according to the prevailing method of calculating the economic effectiveness of new equipment and which, as a rule, it is impossible

to ensure by means of individual measures, should be solved at each stage. (Let us note in parenthesis that if the need for the given items is small, it is necessary to elaborate suggestions on the increase of the output of another, technologically similar basic product for the purpose of the maximum utilization of the potentials of each enterprise. This will make it possible to limit the continuing construction of a significant number of new enterprises, the output of the products of which one should first of all attempt to ensure by operating works.) The expediency of each stage of the planning of new equipment should be confirmed by the possibility of not only obtaining a saving from its use, but also increasing the production volume. In turn, this is feasible only on the basis of the gradual elimination of the bottlenecks by the introduction of new equipment, moreover, at first the existing bottleneck of the enterprise should be eliminated, then the one which appeared next and so on--until the achievement of the indicators of the reference model.

To illustrate what has been said let us examine the following data. Let us assume that the operating production capacity of the foundry of an enterprise comes to 500,000 items, the stamping shop--900,000, the machine shop--1.2 million, the winding shop--800,000, the assembly shop--600,000 and the plant as a whole--500,000. For simplicity let us assume that the enterprise produces one type of product. Consequently, the foundry will be the bottleneck. It is clear that the use of a set of advanced equipment and technological processes for the purpose of eliminating the bottlenecks, first of all in the foundry, then in the assembly, winding and stamping shops and, finally, in the machine shop, is necessary for the increase of the output of the items which the national economy needs. But here a very important question arises: What are the limits of the broadening of the possibilities for the increase of the output of the products of each shop by means of the introduction of new equipment? Moreover, it is not known in advance, how much the possibilities of the basic shops for the production of output increase in case of the elimination of each bottleneck. Due to this it is unclear, which shop becomes the bottleneck at the next undoing. All this sharply decreases the effectiveness of the planning of new equipment.

The analysis of the production capacities of the reference model gives answers to the posed questions. Let us take them to be equal to: for the foundry--1.2 million items, the stamping shop--1.4 million, the machine shop--1.9 million, the winding shop--1.1 million, the assembly shop--1.3 million and the enterprise as a whole--1.1 million. As is evident from the cited data, after the use over the entire technological cycle of the most advanced equipment the winding shop will become the bottleneck, moreover, the enterprise will not have the opportunity to increase the output of products beyond the capacity of the reference model of this shop--1.1 million. Consequently, there is no point in achieving the capacities of the reference models of the other shops, since they exceed the indicators of the winding shop. The increase of the capacities of all shops to its reference values, that is, to 1.1 million, is sufficient. On this basis the capacities of the foundry should be increased by 600,000, the stamping shop--200,000 and the assembly shop--500,000. As to the machine shop, its possibilities today exceed the reference values of the capacity of the winding shop, therefore there is no need to increase them.

With allowance made for the foregoing for the achievement of the indicators of the reference model on the amount of output of products it is possible to note four stages of the planning of deliveries of new equipment to the enterprise (see the table).

(in thousands of items)

Basic shops of plant	Operating production capacity	Change of capacity as a result of deliveries of new equipment by stages			
		I	II	III	IV
Foundry.....	500	1100	1100	1100	1100
Stamping.....	900	900	900	900	1100
Machine.....	1200	1200	1200	1200	1200
Winding.....	800	800	800	1100	1100
Assembly.....	600	600	1100	1100	1100
Plant as a whole.....	500	600	800	900	1100

At each stage by means of new equipment the gradual undoing of one bottleneck occurs. Thus, at the first of them as a result of the introduction of advanced equipment for founding the capacities of the foundry will be increased from 500,000 to 1.1 million items. Here the assembly shop becomes the bottleneck of the plant. At the following stages the capacities of the assembly, winding and stamping shops increase. The distinctive trait of the proposed method of planning new equipment is the fact that at each stage the possibilities of the enterprise for the increase of the output of products gradually increase.

Of course, although the use of new equipment is the most effective method, it is not the only method of eliminating bottlenecks. Before the basic stages of the planning of deliveries of new equipment to a specific enterprise are outlined, all the other possibilities of eliminating the disproportions in the capacities of its individual shops should be exhausted. Among them are the transfer of a portion of the operations from the most busy shops to less busy shops (for example, from the assembly shop to the processing shops), the expansion of cooperation, the introduction of organizational and technical measures and others. However, these measures are of limited importance.

The possibilities of increasing the output of products, when some shop as a whole is the bottleneck of the enterprise, while after its undoing another shop becomes it and so on, were examined above. Here each stage of the planning of new equipment is characterized by the delivery to the enterprise of a set of equipment for one shop, which makes it possible to utilize completely the possibilities of the latter in the increase of the production of items. In practice bottlenecks at an enterprise can arise in individual operations of the technological process in different shops. In other words, in case of the undoing of the bottleneck in the first shop in some operation the next bottleneck can arise in the second shop, further again in the first shop and so on. However, in our opinion, it is inadvisable to plan in the corresponding manner the stages of deliveries of new equipment to an

enterprise. First, it is easier to eliminate the bottlenecks in individual operations of the technological process in different shops by the redistribution of operations in the shop and other measures. Second, the formation of the stages of deliveries of new equipment with allowance made for the set of advanced equipment for the shop as a whole makes it possible not only to solve the problem of increasing the output of products by the expansion of the possibilities of the given shop, but also to improve sharply all the indicators of its activity. Third, in case of the proposed method of planning new equipment at each stage advanced equipment of the same type (within the limits of the technological process for the given shop) will be delivered to the enterprise, which will improve significantly the conditions of its installation, start-up and assimilation, as well as production at specialized plants owing to the increase of the series nature of production.

At the same time the delivery of a large amount of advanced equipment of the same type for a specific shop can at the initial stages of its planning increase its capacity not in conformity with the possibilities of the enterprise. This will lead to the underutilization of the equipment. Consequently, the criterion of the advisability of the use of one amount or another of new equipment is the payback period of the capital investments on its purchase: in case of the least utilization it should be within the limits of the standard permissible period.

We have analyzed the formation of the individual stages of the planning of new equipment from the standpoint of the broadening of the possibilities of the enterprise for the increase of the output of products by means of the undoing of bottlenecks. Moreover, at each stage the introduction of new equipment should contribute to the achievement of the reference values of the costing items of the product cost, as well as the accomplishment of such tasks as the fulfillment of the labor safety requirements, the increase of the quality of production in the given operation, the consideration of social factors and so on. From this point of view a fifth stage of the planning of new equipment: the delivery of advanced production equipment for the machine shop, is added in the considered example. But, as we noted, the operating production capacity of the machine shop exceeds the possibilities of the plant in the reference model. Consequently, it is necessary to use advanced equipment for the purpose of reducing the costs in the given shop and achieving their reference values. Here its structure and quantity should be such that the new production capacity of the shop would be oriented toward the reference capacity of the plant (in the case in question 1.1 million items), that is, at first glance a paradoxical solution will be most advisable: to decrease the operating capacity of the machine shop from 1.2 million to 1.1 million items.

Deviations from the proposed sequence of the formation of the stages of the planning of new equipment are possible in practice. They can occur in those instances when at the given stage of the technological process, for example, there is a high labor intensiveness of the production of products, which differs sharply from other operations, and the significant consumption of materials or when other factors, which stem from the low level of technology, have an effect, moreover, this can occur in a shop which is not the bottleneck of the enterprise. In such cases it might prove to be advisable to use

advanced technological processes and equipment initially in this shop, and not in the shop which is checking the increase of the output of items.

The proposed method of planning new equipment is of particular importance for the sectors with their own base for the copying of special production equipment. Among them is the electrical equipment industry. The Soyuzelektrotekhnologiya All-Union Industrial Association, at which individual scientific and technical innovations acquire mass dissemination, has been set up here. The leading technological institutes of the sector with their own experimental base belong to the association. They develop and test the first models of new equipment and technological processes for the production of electrical products. Series-producing plants, which also belong to the all-union industrial association, copy these models. At the same time the prevailing methods of planning new equipment are giving rise to a number of difficulties for the all-union industrial association.

The association is not meeting the growing need for special production equipment. Its plan is formulated mainly on the basis of the orders of plants, which are guided only by their own interests and do not have data on the prospects of the development of their own subsectors. As a result in the absence of standard data on their actual needs a portion of the special production equipment is ordered "for future use," while a portion of the necessary equipment is not ordered at all. Here a paradoxical situation arises: at enterprises there is often a large amount of poorly used or uninstalled highly productive equipment, which can serve as the basis of the sharp increase of production efficiency, but the latter is increasing slowly. At times new enterprises are built for meeting the need for products which the national economy needs, while the potentials of operating enterprises are utilized far from completely.

Owing to the custom and small-series nature of the production of specialized production equipment the decrease of the labor intensiveness of the technological preparation of production is of great importance. For this purpose the plants of the association require the submitting of orders for equipment 2-3 years before the start of its production. Taking into account that it will provide a real yield after another 1-2 years (including the time for its assimilation), the user plants should have precise data on the plan of their own production approximately 4 years earlier, although the changes with respect to its volumes and range even over 1 year are significant. Under these conditions the equipment, which reaches the plants, does not provide the yield which was planned.

The main purpose of the equipment produced by the plant is to ensure the maximum impact at the user plant. But, since the plan of its production descends in accordance with the cost, the producers give preference not to the most efficient, but to the most expensive equipment. (The situation also does not change in case of the use of the standard net output in planning.) The users are forced to take what is offered to them, while the influence of planning organs is small, since the above-examined shortcomings of the planning of the results of new equipment complicate both the centralized management of the development and distribution of the most efficient equipment and the use of effective economic stimuli for its production.

The use of the proposed method of planning new equipment sharply increases the efficiency of the centralized management of deliveries. Here it is borne in mind that orders will be accepted not for any equipment, but only for that equipment, which the enterprise needs for the elimination of bottlenecks and which makes it possible at each stage of the planning of new equipment to increase the output of the products which the national economy needs and to achieve high ultimate cost accounting indicators of production activity. Moreover, it is possible to increase significantly the series nature of production at the plants which produce the equipment, to create the prerequisites for an effective system of the economic stimulation of the output of new equipment, which has the greatest national economic efficiency, and to determine precisely and take into account the specific results of scientific developments.

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CSO: 1814/77

ORGANIZATION, PLANNING AND COORDINATION

ORGANIZATION OF LABOR AT RESEARCH INSTITUTES, DESIGN BUREAUS

Moscow SOTSIALISTICHESKIY TRUD in Russian No 11, Nov 84 pp 50-57

[Article by Candidate of Economic Sciences V. Moskvin: "The Scientific Organization of Labor at Scientific Research Institutes and Design Bureaus"]

[Text] Why the Number of Workers of Science Is Increasing

At present more than 5 million people already work in the sphere of science and scientific service in our country. The annual expenditures on scientific research and development come to billions of rubles. Such a high level of them requires that these assets be used more efficiently. It is not by chance now that, in striving for the substantial acceleration of scientific and technical progress, our party is posing with all urgency the task to increase sharply the efficiency of science and to spend purposefully every ruble being allocated for these purposes.

The outstanding achievements of Soviet science are universally recognized, but still one must not underestimate the need for the further qualitative improvement of its organization. This is a complicated multidimensional problem, the solution of which will make it possible to achieve a significant economic impact in the national economy. In the opinion of many scientists and specialists, by means of the overall improvement of the organization of research and development it is possible in 5-7 years without significant additional expenditures to increase its efficiency by approximately twofold. If we analyze the statistical data of the expenditures on science, it becomes obvious that it is consuming a greater and greater share of the assets from the national income. Thus, whereas in 1960 the expenditures on it from the state budget and other sources came to 3.9 billion rubles, which corresponds to 2.7 percent of the national income, in 1980 these indicators had already reached 21.3 billion rubles, or 4.7 percent. But can it be said that such a high growth rate of expenditures was accompanied by no less high a growth rate of the efficiency of scientific activity? Hardly. For the present scientific research and development are being developed mainly by means of extensive factors, the main one of which is the attraction of additional manpower and material resources.

What is hindering the development of science by means of intensive factors, is not making it possible to use the scientific potential efficiently and is

responsible for the unsound increase of the number of workers in this sphere? Here it is possible to single out five basic factors.

First, there is a gap in the sphere of plans at the statewide and sectorial levels. In particular, the mandatory coordination of the plans of the scientific research institutes of the USSR Academy of Sciences and the academies of sciences of the union republics with the plans of sectorial institutes is not being ensured, which is delaying the transfer of scientific ideas from basic to applied science. A promising means, which makes it possible to eliminate this shortcoming, is the introduction of goal program methods of planning and management. In our opinion, the now prevailing methodology of work on all-union programs evokes serious complaints. Thus, the Ministry of Installation and Special Construction Work in accordance with the approved form specified about 1,000 stages of 50 all-union programs, in the fulfillment of which the ministry is participating, and more than 4,500 stages of sectorial programs. The institutes of the sector spent several months on filling out the appropriate documents. When the work was completed and the five-year plan began, the complete uselessness of the majority of expenditures was confirmed, since subsequently of all the forms only one, in accordance with which the assignments are being adjusted, was used.

Second, in the sectors there are in fact no scientific centers which would deal with the organization of scientific research and development, as well as the increase of their efficiency. At present practically all the scientific research institutes and design bureaus themselves go to the management of their association or administration, with which they also decide what to do and within what time. And therefore the entire set of supply orders is not analyzed from the point of view of the interconnection of the themes and their actual necessity. Frequently the scientific research and experimental design operations, which are performed by different organizations, unjustifiably duplicate each other, the obtaining of not those types of the final product, which the sector or national economy needs, is planned. For example, the writing and approval of a scientific and technical report on a theme are often planned as the only end result of scientific research work, although a specific standard or guiding technical material is needed.

Third, the scientific research institutes and design bureaus fulfill a large number of assignments which do not have a direct bearing on scientific research. These are all kinds of assignments of the ministry, in essence the replacement of its staff, as well as patronage operations. The fact that the state incurs losses as a result, is quite obvious. The maintenance of unnecessary, inefficiently working personnel not only distorts the amount and structure of the expenditures on science, but also does moral harm to society, hindering productive scientific activity within the organization. It should be noted that given the reduction of the staff of scientific research institutes and design bureaus, which is mechanically established from above, in practice this portion of the personnel is not reduced, since the accountability for "nonbasic" operations is often more strict than for the results of scientific research.

Fourth, the existing structures of scientific research institutes and design bureaus are not always in line with the tasks facing them. Whereas initially they were set up for the solution of some very urgent problems for that time and it was impossible to do without them in the sector, with time the situation changed. With the emergence of new problems the organization developed its own structure, new subdivisions and new personnel appeared. But inasmuch as associates had to be recruited for a new job, as a rule, in an extremely short time, since otherwise they could "trim" the allocated staffs or use them for other needs, particular demandingness was not made in this case on the personnel. It was believed that it would be possible to correct later the mistakes in their selection and placement under calmer conditions, which usually do not set in. But here is what is characteristic: when some problem is settled or some task is accomplished, no one is freed for the fulfillment of new ones. The subdivisions themselves find work for themselves, striving wherever possible not to change the theme and to engage in familiar work. In other words, a portion of the organization begins by itself to create problems, while evading new, actually arising, but difficult problems.

An efficient system of periodic extradepartmental certification, which is implemented under the supervision of the State Committee for Science and Technology and the USSR Academy of Sciences, in our opinion, could help to eliminate this shortcoming. During such certification it is advisable to check whether the theme being fulfilled is in line with the tasks of the sector and the national economy as a whole, as well as with the posed tasks, what the scientific and technical level of the research and development being fulfilled and the level of their organization, the state of the work on the increase of the efficiency of the activity of scientific research institutes and design bureaus, on the selection and placement of personnel are. The organization of temporary subdivisions for the most important national economic problems is also very promising; such experience exists in a number of developed countries.

Fifth, the level of the organization of labor at scientific research institutes and design bureaus is low. This is a very serious shortcoming, which is most responsible for the need to attract additional manpower resources. It is revealed quite simply. If in the organization there is not a good base of the standards of labor expenditures, there is no efficient planning of individual labor and, consequently, the conditions for the objective evaluation and stimulation of its results are absent. If all this exists, there is, as a rule, also a set of documents, which regulate the activity of the workers and the organization as a whole and are drawn up as standards of the enterprise, statutes and instructions. All the measures aimed at the improvement of the organization of the labor of personnel are interconnected here, which attests to its high level in the collective.

What specifically is it necessary to do in order to shift from the extensive to the intensive development of science and to halt the unjustified increase of the number of people employed in it? Without belittling the importance of eliminating all five listed shortcomings, still it is first of all necessary, in our opinion, to increase substantially the level of the work on the scientific organization of labor at scientific research institutes and design

bureaus, since precisely this factor influences to the greatest degree the attraction to the sphere of science of additional, and to put it more precisely, unnecessary manpower resources.

In order to gain an understanding of the situation which has formed in the area of the organization of labor at scientific research institutes and design bureaus, it is advisable to examine briefly the history of the question. It is possible to distinguish here three conspicuous landmarks: 1967, 1972 and 1978. The 1967 All-Union Conference on the Organization of Labor in Industry and Construction also provided a significant impetus for the analysis and generalization of experience in order to use it when improving the organization of labor at scientific research institutes and design bureaus. On the basis of such an analysis in 1972 the Scientific Research Institute of Labor published intersectorial recommendations on this question, which to date have not lost their significance. There the set of basic directions of the scientific organization of labor at scientific research institutes and design bureaus was specified and the means of its development were outlined. Finally, in 1978 the All-Union Applied Science Conference "Problems of the Scientific Organization of Labor at Scientific Research Institutions, Design, Technological, Planning and Surveying Organizations in Light of the Decisions of the 25th CPSU Congress," which marked the beginning of the present stage of development of the scientific organization of labor in science, was held for the first time. In its recommendations it gave a definition of the scientific organization of labor as applied to the personnel of scientific research institutes, design bureaus and planning and surveying organizations and specified the list of its basic directions and the means of improving the work in each of them.

What has been done since then? Unfortunately, little. To date the main organizations for the scientific organization of labor at scientific research institutes and design bureaus have not been specified in all sectors. In the majority of them either the corresponding subdivisions do not exist at all or they exist formally, but are busy with other, "more necessary" work. In the country there is no unified center, which would constantly study these problems, coordinate research and development, analyze and generalized advanced know-how and prepare procedural and standardized materials. During the period, which has passed since the 1978 conference, the situation has been aggravated even more. The research in the area of the improvement of the organization of the labor of scientists has advanced substantially and has come into even greater conflict with the existing forms of the organization of this work.

The Directions of the Work

In recent years definite changes have emerged in the development of the standard base for the improvement of the organization of labor at scientific research institutes and design bureaus. In particular, unified sets of organizational and administrative documents, which consist of interconnected standards of enterprises, statutes and instructions, which regulate the organization of research and development, have appeared. At several institutes and design bureaus there are sufficiently powerful modern systems of documents, which serve as a basis for the increase of the efficiency of

their activity. Thus, the set of organizational and administrative documents of the Central Scientific Research Institute of Information and Technical and Economic Research for Instrument Making, Automation Equipment and Control Systems, which has received a high rating by specialists and has been commended by medals of the Exhibition of USSR National Economic Achievements, includes more than 70,000 interconnected documents, which contain more than 8,000 requirements of the scientific organization of labor. By the beginning of the second quarter of 1984 these documents has been turned over for use as standard documents to more than 1,400 organizations and enterprises, which has already yielded an economic impact of many millions of rubles. The standards of the SPEKTR system, the documents of the Ritm Center of the Scientific Organization of Labor and a number of other organizations have received recognition.

In the recommendations of the applied science symposiums "The Social and Economic Aspects of the Increase of the Efficiency of Science in Light of the Decisions of the 26th CPSU Congress" (Moscow, June 1984) and "The Social and Economic Aspects of the Increase of the Efficiency of Soviet Science" (Zvenigorod, May 1982), which were held by the USSR Academy of Sciences, it is indicated that an intersectorial program of the elaboration and introduction of a unified set of organizational and administrative documents at scientific research institutes on the basis of model decisions is necessary. In this program the following is first of all envisaged: to specify the organs, which are responsible for the preparation and introduction of organizational and administrative documents at scientific research institutes on the scale of the country and individual sectors, to establish a bank and classifier of organizational and administrative documents, as well as a list of model organizational and administrative documents. Moreover, it is planned to compile and publish a collection of standard documents, which regulate the management of the activity of scientific collectives and the processes of the implementation of the results of research and development and to hold once in 2 years at the Exhibition of USSR National Economic Achievements competitive exhibitions of the best organizational and administrative documents.

While speaking about the prospects of the development of sets of standard organizational and administrative documents at scientific research institutes and planning and design organizations, it is possible to note that at present the possibility to increase the efficiency of their activity on the basis of their regulation already exists. At times one has occasion to hear that the high level of such regulation is not conducive to creativity. This is incorrect. At any organization there are thousands of jobs and operations, the time and the quality of the performance of which depend first of all on the punctuality of the performers. Good organization and order--these are precisely the basis on which scientific and technical creativity can be effectively developed. Not without reason did G. Emerson indicate more than 50 years ago that the enterprise, which lacks standard written instructions, is not capable of steadily advancing. Perhaps, this assertion has lost its topicality for us? Not at all. Life constantly confirms the rule that precise order is the basis of progress in any area, which sociologists now understand especially well. It is impossible not to agree with V. A. Yadov that "today, when the party is posing the task of the intensification of all social production, efficiency, responsibility, discipline and punctuality,

that is, precisely those qualities of character, which historically proved to be 'scarce,' are becoming most valuable and entirely necessary. Not in the least less than resourcefulness and a creative approach to work."[1] The development of large sets of interconnected documents is a common trend everywhere that a high level of organization is required.

Several positive results have been achieved in the improvement of the forms of the division and cooperation of labor. In practically all organizations there are statutes on the structural subdivisions and on the scientific supervisors and responsible performers and job instructions, work has been performed on the standardization of the structure of scientific research institutes and design bureaus. The quality of these documents, as well as the conformity of the structures of organizations to the goals and tasks posed for them are another matter. Under the conditions when at many scientific research institutes and design bureaus the statutes and instructions exist only formally, it is necessary first of all to create the conditions for the efficient implementation of the rights and duties, which are recorded there. The worker of a scientific research institute, who holds a specific place in the organizational structure, for example, the chief of a laboratory, in the scientific structure can perform the functions of the supervisor of one theme and at the same time be the responsible performer for another. It is important to see to it that the rights and duties of the same associate, which exist in the different structures, would not come into conflict with each other. In practice this is achieved by combining the rights and duties of workers, which are contained in the job instructions, the statutes on the supervisor of the theme and the responsible performer, on the chief designer of the system, the subsystem and others. One must not underestimate the difficulty of solving this problem. For example, as a result of the lack of combining the effectiveness of the brigade organization of labor in the sphere of science decreases substantially, leading to conflict situations between the line managers and the managers of the creative brigades. As practice shows, it is possible to cope most successfully with this matter in organizations which have a developed set of organizational and administrative documents.

As to the standardization of the structures, here it is probably necessary to look into much more. It is generally recognized that the structure of an organization should constantly be developed with allowance made for the changing goals and tasks. Standardized planning could help to ensure this, if standards existed, in which it were indicated, to what problem or task some structural components or others should correspond both quantitatively and qualitatively. Now in no sector are there two scientific organizations with identical organs and tasks and are there the above-mentioned standards, but there are model structures. At the same time it would be incorrect to reject the idea of such standardization. It seems that it should rest on a good standard base and should not pass that level of detailing of the components, which can be substantiated in the standards.

Perhaps, the most disputes of all in the press and in verbal statements are over the standardization of the labor of scientists and engineering and technical personnel. Some claim that it is possible to standardize any mental labor, including creative labor, while others claim that this is impossible. Without going into the dispute, let us note that along with the objective

increase of the need for standards in scientific research and experimental design work the interest of researchers in this problem has decreased to a certain extent. It is not new, creative works were published back in the early 1970's. Since then many researchers have become convinced that the carrying over of methods, which are effective for the standardization of the labor of workers and employees, as applied to scientific activity does not yield significant practical results. They have lost sight of scientists, without having provided the necessary procedural recommendations. Even under the conditions of the Leningrad experiment, when differentiated standards, which make it possible to draw up standardized assignments for 65 to 100 percent of the engineering and technical personnel, have been developed, in practice the labor of the personnel of scientific research subdivisions is not being standardized.

It should also be noted that in the literature the achieved results in the area of the standardization of scientific research and experimental design work are somewhat exaggerated. The analysis of concrete experience shows that, as a rule, the standards of labor intensiveness are actually intended only for the designing and development of technological processes. The identification of the standards for planning and design and scientific research work, the approaches to the development of which are not entirely analogous, contributes to the overestimation of the available experience in this area and complicates even more the solution of the problem. Obviously, in order to broaden the sphere of the standardization of the labor of engineering and technical personnel, it is necessary to formulate a classifier of the operations, which are performed in the process of research, to develop the methodology and to substantiate theoretically the boundaries of the standardization of various types of mental labor and to elaborate intersectorial standards for the types of the final scientific product. It should be specially noted that the attempts made at times to establish standards of labor expenditures in isolation of the improvement of the organization of labor in the other directions, that is, in circumvention of the principle of comprehensiveness, cannot lead to serious success. Standardization is too closely connected with the other directions of the scientific organization of labor for it to be possible not to take this internal interconnection into account.

Now, probably, it will not be possible to find a scientific research institute or design bureau, in which they do not engage in the search for methods, which make it possible to evaluate objectively the activity of collectives of the subdivisions and associates. Here, incidentally, it is appropriate to recall the "Karpov" system of the evaluation and remuneration of the labor of scientists and specialists, to which by now 67 scientific research organizations have converted. The positive aspects of this experiment, which has been in progress since 1968, have been described in sufficient detail in the press. At the same time in recent years other effective methods, for example, the systems of the evaluation of the activity of subdivisions of the Institute of Control Problems or the Ural Affiliate of the All-Union Scientific Research Institute of Heat Engineering imeni F. E. Dzerzhinskiy (UralVTI), have also appeared. The latter is being introduced at scientific and planning and design organizations of Chelyabinsk. The system of the remuneration of labor and the payment of bonuses for the end results of work

on the basis of supply orders, which is in effect at the Ulyanovsk Special Design Bureau of Heavy Machine Tools and Milling Machines, is very interesting. Obviously, it is expedient to constantly generalize the experience and to disseminate all its positive components, thereby ensuring the continuous development of this direction of the scientific organization of labor.

The creation of comprehensive systems, in which the evaluations of the activity of the organization as a whole, its structural subdivisions, managers and rank and file associates would be interconnected, seems promising, moreover, both the achieved results and the opportunities which existed should be evaluated. Such an approach will make it possible to overcome the shortcomings of both methods which are presently being used--with respect to a similar object during the same period or for the same object with respect to a past period, since they do not take into account the degree of realization of the potentials. Moreover, it will be possible to judge objectively the efficiency of activity and in practice to coordinate the systems of stimulation with its actual increase.

At several scientific research institutes and design bureaus a search is being made for means of the development of interconnected systems of passports (of the organization, the subdivision, the associate and the theme), sociopsychological methods, particularly testing methods, for the improvement of personnel work and dialogue automated systems for the implementation of the functions of the monitoring of the activity of the organization are being introduced, standards of labor expenditures are being used for the evaluation of the results of the labor of researchers and developers. All these undertakings at the intersectorial and sectorial level are not being coordinated, and due to frequent duplication unnecessary expenditures on the solution of already solved problems are arising at various organizations.

A System Is Needed

At present individual enthusiasts are studying the problems of the organization of labor at scientific research institutes and design bureaus. In large cities they are united in the scientific sections attached to the houses of scientific and technical propaganda. Their interests are focused mainly on the questions of planning at scientific research institutes and design bureaus and the improvement of the evaluation of the activity of their collectives and individual workers. As for such directions as "The Designing and Introduction of Efficiency Labor Processes" and "The Creation of Favorable Working Conditions," in practice there is very little gained positive experience here.

It seems to us that it is impossible to regard as normal the formed situation, in case of which the development of the scientific organization of labor at scientific research institutes and design bureaus depends entirely on the initiative of individual specialists. Obviously, a statewide system of the performance of work in this area, which is similar to the one which was formed for the improvement of the organization of labor at industrial enterprises, should be established.

Indeed, let us suppose, the director of a completely new scientific research institute decided to introduce at his institute the organization of research and development and, hence, the organization of labor in conformity with the latest achievements of science and the most advanced practice. Where should he turn? Nowhere. There are individual scientific research institutes, which have positive experience in several directions, there are individual specialists, who are dealing with these problems. But such a director will not find an organization or service, in which they could give comprehensive detailed recommendations on the scientific organizational of labor. But since there is no system, managers--both new and experienced--have to organize the work at their own discretion.

It can be asserted with good reason that this is seriously hindering the realization of two progressive trends in the economy: the broadening of the independence and responsibility of organizations and enterprises and the changeover to the evaluation of the results of their activity not according to individual most important indicators, but according to a single integral indicator, which characterizes the increase of efficiency during the period being evaluated. It is obvious that the increase of the level of the organization of research, development and production and, accordingly, the organization of labor is a substantial reserve of it for scientific research institutes, design bureaus and enterprises. The success of the solution of a number of problems in the main directions of scientific and technical progress directly depends on this.

What was said above does not at all mean that in the country there is little advanced know-how in this area, it does, of course, exist. The difficulty is in something else--the achievements of individual organizations and specialists are not compared constantly and systematically and are not being systematized. Therefore it is practically impossible to judge what is better for the given specific conditions and what is worse. On the other hand, along with the positive, although unsystematized experience, there are a large number of not completely solved problems. It is a question of standards of labor expenditures on scientific research work, the legal support of scientific research and development, the methodology of the formation of efficient research groups and the optimization of the standards of the number of specialists for scientific research institutes of different types. Efficient structures, objective methods of the evaluation of the personal labor contribution of the scientist and effective systems of material and moral stimulation are also needed.

The combination of the set of unsolved problems and uncoordinated, unsystematized experience created a situation, when it became very difficult to evaluate objectively the level of the organization of the labor of researchers and developers, which exists at a scientific research institute or design bureau, as well as the real prospects of its improvement. The appropriate organizational base, let us repeat, is needed in order to unravel this knot. For this, obviously, within the framework of the prevailing system of the management of labor and within the limits of the existing staffs it is expedient to single out a scientific research center, perhaps of dual subordination (to the USSR State Committee for Labor and Social Problems and the State Committee for Science and Technology). The study of the problems of

the scientific organization of labor in organizations, the coordination of research and development in this area, the generalization of advanced know-how, the preparation of materials on it, as well as general sectorial procedural and standardized materials and the procedural supervision of the introduction of the scientific organization of labor at the scientific research institutes and design bureaus of the main organizations of the sector will be included in its tasks.

In turn it is advisable in the main organizations to establish special divisions (again within the limits of the existing staffs). They will carry out the coordination of work, prepare sectorial guiding, procedural and standardized documents and take part as coperformers in the research and development, which are being conducted in the system of the USSR State Committee for Labor and Social Problems. At scientific research institutes and design bureaus divisions, laboratories or sectors of the scientific organization of labor, which should deal with the direct improvement of the organization of labor at their institutions, as well as take part in the fulfillment of general sectorial scientific research and development, are being formed with allowance made for the size of the organizations.

For the discussion of the most important problems of the scientific organization of labor in this area, the elaboration of effective ways of solving them, as well as for the evaluation of proposed major innovations and the achievable results it is advisable to set up a permanent scientific council for the problem of the scientific organization of labor at scientific research institutes and design bureaus. It would also make sense to organize at the Exhibition of USSR National Economic Achievements the permanent intersectorial exhibition "The Scientific Organization of Labor at Scientific Research Institutes and Design Bureaus," on the basis of which it is possible to hold seminars for the exchange of advanced know-how.

FOOTNOTE

1. "Youth and Labor," EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA, No 8, 1983, p 123.

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ORGANIZATION, PLANNING AND COORDINATION

TECHNOLOGICAL DEVELOPMENT AT NOVOKRAMATORSKIY MACHINE BUILDING PLANT

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 12, Dec 84 pp 53-57

[Article by Doctor of Economic Sciences Professor G. Dobrov, A. Gavrishko (Kramatorsk) and Candidate of Economic Sciences V. Musiyenko: "The Technological Orientation of Plant Science (The Experience of the Novokramatorskiy Machine Building Plant)"]

[Text] In 1984 the Novokramatorskiy mashinostroitel'nyy zavod [NKMZ] Production Association was 50 years old. The association greeted this glorious date with significant achievements both in the production of heavy machine building products and in the sphere of the management of the scientific and technical development of production.

The rolling mills, wheel and walking excavators, heavy-duty presses and other single-design equipment, which are produced by the association, are influencing significantly technical progress in the metallurgical, mining, power and other sectors, and in a number of cases govern their technical level. Only the highest and first quality category are awarded to the products of the NKMZ Production Association, and more than 30 models of machines have the Emblem of Quality. Equipment with the NKMZ mark has a broad demand in all the socialist countries, as well as on the markets of France, Japan, the FRG and other states.

The assurance of a high quality of products requires a leading rate of increase of its technological possibilities. The NKMZ Production Association is implementing a program of the development of automated and specialized workplaces with the use of industrial robots. During the current five-year plan another 36 new sections with the use of 7 modern systems of industrial robotization are being added to the already existing 78 completely mechanized sections and lines.

The achievements of the NKMZ Production Association in the area of the management of scientific and technical progress and the availability of a powerful production, scientific and technical potential were responsible for the decision on the inclusion of the association among the enterprises, which are conducting the statewide economic experiment on the broadening of the rights in the area of the planning and conducting of economic operations, as well as the increase of their responsibility for the results of work. It is

natural that participation in such a vital experiment required the mobilization of the entire collective for the accomplishment of the tasks of the intensification of production, which were set for it.

The experience of the Novokramatorskiy Machine Building Plant shows that the solution of the problems of the further increase of the scientific and technical level and competitive ability of the equipment being produced is possible only by means of the substantial improvement of the technological characteristics of production on the basis of the use of scientific and technical innovations. Precisely such problems were spoken about at the June (1983) CPSU Central Committee Plenum: "Immense work on the development of machines, devices and technologies of both today and tomorrow awaits us. The automation of production has to be carried out, the most extensive use of computers and robots and the introduction of versatile technology, which makes it possible to change over production quickly and efficiently to the making of new products, have to be ensured."

Let us examine two essential and characteristic features in the activity of the association on the development and introduction of advanced technologies.

First, the essence of the systems approach to the technological development of production, which is being implemented at the NKMZ Production Association, consists in the fact that not individual technological processes, but complete technological complexes (technological systems--TS's) are being developed and assimilated here. President of the Ukrainian SSR Academy of Sciences Academician B. Ye. Paton wrote with regard to such an approach to technologies: "When speaking about technologies, we understand that they encompass the entire complex of the production of one product or another as a whole. The technological process, as a rule, is the corresponding unit of the technology as a whole."[1] In conformity with current views the technological system is a functionally interconnected set of methods, technical means and social conditions of their use, which determine the organizational and technical level of production and its potentials. The technological system, which is understood in this sense, includes three components: technological process support (the methods and procedure of carrying out technological processes, technical rules, technological regulations and so on); equipment and machinery support (the stock of machine tools, industrial robots, instrumentation and control equipment, computer technology and others); organizational and management support (adopted organizational structural decisions, established procedures of management, economic and standardized acts, standards and others). Academician A. G. Aganbegyan called such systems "integral technological economic systems."[2]

Second, the creation and efficient assimilation of advanced technological systems require new organizational forms of their development and introduction, which ensure the use of a wide range of achievements of science, which has made urgent in recent years the needs of production for a scientific and technical potential. Here what are meant are not only the scientific and technical forces proper, which are a part of the association, and not only the sectorial scientific and technical potential, which is oriented toward the development of the given works, but the entirety of the scientific and technical forces of the country, which can directly take part in the

accomplishment of the corresponding set of tasks. This scientific and technical potential, which is at the disposal of production, is the set of purposefully formed manpower, material and technical, information and organizational structural resources, which determine the ability to solve the problems of scientific and technical development, which face production.

We made estimates of the scientific and technical potential, which is at the disposal of production, according to the criteria of its conformity to the specific goals of the development, introduction and practical assimilation of new technologies--so-called problem-oriented estimates. The supply with the basic components of the scientific and technical potential of the operations on the development and assimilation of the technologies of the automation of welding (gas cutting on NC machines, an automated design system of welding, automatic welding by robots); the robotized complex of the cold stamping of blanks; the automated control system of the technological process of electroslag remelting; technological systems of electroslag casting, as well as special technological systems, which are designed for the production of single-design equipment, and others were analyzed. Along with the evaluation of the entire set of studied technological systems a group of automated and robotized technological systems (ARTS's) was specially singled out among them. In addition to the use of the data of scientific, technical, planning and organizational documents, expert appraisals were specially conducted among the leading specialists of the NKMZ Production Association. Here the level of the characteristics in question was estimated according to a five-point scale (see the table).

Problem-Oriented Estimates of the Scientific and Technical Potential of the Novokramatorskiy Machine Building Plant

Structure of scientific and technical potential	Technological systems	Automated and robotized technological systems
Manning	4.38	3.48
including:		
leader	4.25	3.45
specialists	4.50	3.50
Material and technical supply	4.06	2.95
including:		
scientific tools (instruments, equipment and so forth)	4.00	3.11
pilot experimental base	4.13	2.79
Information and procedural support	3.75	3.00
including:		
experience of research and development	3.88	3.25
stock of scientific and technical results	3.63	2.75
Organizational support	3.94	3.47
including:		
specialization of subdivisions	3.88	3.25
organizational and economic ties with coperformers	4.00	3.68
Scientific and technical potential	4.03	3.23

The breakdown of the generalized estimates according to the automated robotized technologies (ARTS's) and the set of other analyzed technological systems (the technological systems of the production association) shows that the level of supply of the automated robotized technologies with the potential is appreciably lower. This is explained by the fact that the potential for the development of both these and other technologies is the same, while that of the problems, which arise in case of the development, introduction and assimilation of automated control systems and computer technology, NC machine tools and robots, is much higher and they are more complicated than in case of the development of "ordinary" technological systems.

Manning means the availability of a leader and specialists of the required skill in a number, which is sufficient for the successful accomplishment of the posed tasks. In this case a specialist in the given engineering and technical or scientific field, who is capable of solving independently the arising technical, organizational introduction and other problems and of mobilizing the collective for the achievement of specific results, is considered the leader. From the obtained estimates it is evident that for the enterprise the task of the training and the increase of the skills of scientific and production personnel, who deal with questions of the development and use of technologies of the automation and robotization of production, is a priority task. The relatively low estimate of the pilot experimental base stems from the specific nature of the pilot development of technological systems under the conditions of the Novokramatorskiy Machine Building Plant, which requires the use of the basic production capacities. The equipment produced by the association frequently is of single design, usually of large dimensions, moreover, only single models are produced, which precludes the development of the pilot experimental base in traditional forms. Domestic and world experience testifies that for such conditions it is advisable to develop integrated and mobile systems of the modeling and testing of new models of equipment, which are provided with the necessary analog and digital simulators and special software, sets of measuring and diagnostic equipment. The strengthening of the material and technical supply of operations on the technological development of the NKMZ Production Association by means of powerful laboratory facilities and research and experimental equipment is oriented precisely in this direction.

The values of the estimates of the informational and procedural and the organizational support testify to shortcomings in the operation of the patent information services and the lack of development of decisions on the specification of the specialization and cooperation of the scientific, production and support subdivisions.

In the study made by us the basic characteristics of the scientific and technical level and the quality of the technological systems being introduced at the NKMZ Production Association were also evaluated. The made analysis showed that the degree of novelty of the technological processes in the typical case exceeds by 15 percent the novelty of the systems of machines and equipment, which are used in them (this concerns the automated and robotized technological systems). This fact conforms to the objective requirements of modern scientific and technical development. However, it was noted here that given the high degree of novelty of the technological processes and systems of

machines the corresponding demands of automated and robotized production on organization and management are met at a low level, and frequently are not taken into consideration at all. The lack of the timely elaboration when designing technological systems of decisions on the management of production, specialization, cooperation, the organization of start-up and adjustment work and maintenance and the training of personnel had the result that these factors account for about 40 percent of the cases of the delay of completion of the operations on the assimilation of the investigated technological systems. Of course, the required steps and organizational decisions are also made in those instances when they are not envisaged in advanced, but then they are implemented under critical conditions, in case of strict time and resource limitations and, of course, lead to the excessive consumption of forces and assets and the diversion of personnel and production capacities from the fulfillment of the current plan assignments.

It is possible to name the contract on the creative cooperation of a group of enterprises, which was concluded on the initiative of the NKMZ Production Association and is aimed at the intensification of welding on the basis of automation, as one of the examples of an original solution which ensures the successful assimilation and use of modern technological systems. The increase of the efficiency of the use of computer technology, NC machine tools and machines and robots and the assurance of their stable operation are its goal. Organizations which belong to different departments, for which the problems connected with the robotization and automation of welding operations have become urgent, are parties to the contract. The exchange of advanced know-how, proposals and information on the available scientific and technical developments, the coordination of operations on the development of domestic functional blocks (analogues) in place of imported blocks, the formation of a unified catalogue of spare parts and equipment and the exchange of technical specifications and spare parts are being carried out within the framework of the indicated cooperation. During the time of effect of the contract the number of idle times of expensive automated and robotized equipment and NC machine tools has decreased. The basic organizational and technical questions, which concern the cooperation of enterprises, are settled by the coordinating council. The group of participants is not limited and is constantly increasing by means of those who desire to make their own contribution to the collective solution of the problems of the automation of welding.

In the opinion of plant specialists, the organization of the conducting of the sectorial and, in the future, also the statewide certification of technologies is one of the directions of the increase of the quality of technological systems and the increase of the competitive ability of the output produced by them. For this purpose we evaluated the legitimacy of the distinction of three categories of quality of technological systems. The made analysis showed that the technologies, which are assigned to the second quality category, provide the output of products, which do not meet present requirements, and are liable to immediate updating on the basis of essentially new scientific and technical decisions.

The experience of the Novokramatorskiy Machine Building Plant and the data of the study show that the certification of technological systems should be

carried out only for two quality categories--the highest and the first. This objectively governed requirement is in keeping with the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy" (1983).

Analytical calculations show that the basic reasons for the decrease of the scientific and technical level of individual automated and robotized technological systems as compared with the set technical assignments are (in descending order of importance): the shortage of personnel of the corresponding skills; the inefficient organization of work; difficulties with financing and material and technical supply; the inadequate supply of operations with scientific equipment and instruments; the increased level of the technical demands on technological systems. The following factors were also named: the lack of technical and technological possibilities of production; the lack of experience; the imperfection of the methods of research; the lack of a leader; the nonconformity of the pilot experimental base to the tasks of production; the inadequate information support of operations. From the cited list it is evident that components of the scientific and technical potential came to be among the basic causes of the decrease of the quality of technological systems. Therefore, for the NKMZ Production Association the task of the goal-oriented increase of the scientific and technical potential, and not last of all by the further development of the interrelations of science with production, is very urgent.

It seems that the relations between the developers of technological systems and production should be at a higher level and be distinguished by stability. However, the real situation (the statistical distribution of the closeness of connection) looks different. After the completion of the planning, design and technological operations a significant decline begins, but then the closeness of connection increases in case of the assimilation of the given production technologies, yet still does not reach the former level.

According to the data we have, the most significant types of assistance, which is given to production in the process of the assimilation of technological systems on the part of scientific research, design and planning organizations, are the following (in descending order): the training of personnel, assistance in the performance of repairs and operations, which are connected with breakdowns of equipment, instruments and so on; assistance in the organization and performance of maintenance; the installation of equipment and start-up and adjustment work.

Life shows that not only efforts on bringing science closer to production, but also special measures on the convergence of science itself with production are necessary for the solution of the problems of increasing the economic, engineering and scientific potential of the association. At present in the majority of cases science-production contacts are established without the appropriate program planning basis. Production occasionally enlists for the solution of already arisen problems the potential of research, planning, design and technological organizations and higher educational institutions.

A comprehensive plan of the creative cooperation of the NKMZ Production Association with the leading institutions of the Ukrainian SSR Academy of Sciences was formulated on the basis of the experience of other production associations and scientific organizations.[3] The characteristic features of this cooperation are its orientation toward the introduction of advanced technologies which are based on the achievements of basic research. The substantial increase of the overall scientific and technical potential, which is oriented toward the acceleration of the retooling of production, is thereby ensured within the framework of the cooperation of academic science and production.

For the organization of the internal research and technological design resources of the Novokramatorskiy Machine Building Plant and all the scientific and technical forces, which are being enlisted by the production association, a scientific research, planning and design technological institute was established and is operating directly within the production association. The 7 years of experience show that the institute of the Novokramatorskiy Machine Building Plant is contributing to the formation of a sound strategy of technological development, the broadening of the scientific and technical interests of the production association and the improvement of the coordination of operations in case of the development, introduction, assimilation and use of new technology and equipment. The role of the institute of the Novokramatorskiy Machine Building Plant in the formulation of an efficient scientific and technical policy in the association and the implementation of the plans of technological development is decisive. In addition to the performance of independent scientific research and experimental design work, the institute ensures cooperation with 50 institutes and scientific organizations of the country, including 27 institutes of the Ukrainian SSR Academy of Sciences, and is implementing a comprehensive approach to the engineering and design, technological and organizational preparation of production, including the contract supervision of the installation of pilot industrial equipment, service, the introduction of automated control systems and automated design systems. Patent and license work, standardization and unification, the dissemination of advanced know-how, the certification of equipment and the certification of workplaces are among the questions which are settled centrally by the scientific research institute. All the listed and many other problems are being solved in conformity with the system of the management of scientific and technical progress, which has been established at the association.

The need for the goal program management of the technological development of production has objectively formed at the NKMZ Production Association. The existence of specific factors, which influence the time and results of the technological retooling of production, the participation of a large number of coperformers and the resource and time limitations, which are imposed of the processes of the development, introduction, assimilation and use of modern technologies, require more complete coverage by goal program management (according to our data, only a third of the investigated technological systems were developed within programs). Let us emphasize that it is a question of the base technological systems, which determine the specialization and level of the given type of production, and not of individual technological processes.

The organization of the fulfillment of the goal programs of the scientific and technical development of production required the formation of a special matrix structure of management. In such a structure the staff of the program carries out the performance of management procedures and ensures a connection between the individual functional and line organs. The scientific research department of the development and introduction of new equipment, which is a part of the institute of the Novokramatorskiy Machine Building Plant, is the base of such a staff organ and the coordinator of program operations in the association, while the supervision of the implementation of all programs is carried out by the chief engineer.

The developing subdivisions, the production shops and services, in addition to the fulfillment directly of the program assignments, have permanent functions, which may constitute a part of the program, but might also not be a part of it, but might be performed in accordance with other plan assignments. For these purposes in a number of services work is being performed on the broadening of the staff functions (in the division of product quality control, the division of the chief designer of general machine building and others) by the introduction of tasks of goal program management. The specification of the structure of the divisions with allowance made for the formation within them of special working groups, which are responsible for the program operations, and of the regulation of the rules, duties and procedure of the interaction of the indicated groups is being planned for this.

The experience of the participation of the NKMZ Production Association in the economic experiment, which is being conducted for the purpose of the broadening of the rights of enterprises in planning and economic operations, as well as the increase of their responsibility for the results of work, and the principles of goal program management required of the association the improvement of intraplant planning, the specification and precise coordination of the plans of scientific and technical progress and the revision of standard documents. The realization of the advantages of the goal program approach under the conditions of the economic experiment will make it possible precisely within the framework of the programs to form temporary scientific and technical collectives for the achievement of long-range and especially important goals, in particular, the development, introduction and assimilation of new technologies. Scientists, designers, processing engineers, operators and adjusters should be included among them, while providing them on a precise program plan basis with material, technical and financial resources. The turning over on the set date of a completely finished development, which has been adjusted in production, and its extensive dissemination are the basic indicator of the work of such collectives.

The experience of the Novokramatorskiy Machine Building Plant attests that the organization of the goal program management of the technical and technological updating of production will ensure the timely development and assimilation of advanced technologies, which are based on the leading achievements of science, will make it possible to solve the problems of the material reward of specialists, will increase the technological standards of production and will ensure the increase of the scientific and technical potential of this

enterprise in conformity with its place in the scientific and technical progress of the country.

FOOTNOTES

1. See B. Paton, "The Development of New Technologies Is an Urgent Task of Scientists," VISNYK AKADEMIYI NAUK URSR, No 12, 1979, p 54.

2. PRAVDA, 14 July 1984.

3. Such experience of cooperation of the USSR Academy of Sciences and the Ukrainian SSR Academy of Sciences with the Moscow Motor Vehicle Works imeni Likhachev is well known (see, for example, EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA, No 10, 1982).

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CSO: 1814/71

ORGANIZATION, PLANNING AND COORDINATION

PLANNING, MANAGEMENT OF TECHNOLOGICAL PROGRESS

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 1, Jan 85 pp 64-71

[Article by Doctor of Technical Sciences Professor B. Rayzberg, chief of a department of the Scientific Research Institute of Economics attached to the USSR State Planning Committee: "Technological Progress: Planning and Management"]

[Text] Under the conditions of the intensification of the economy the improvement of production technology is assuming an increasing role. In recent decades it has turned into a major, relatively independent branch of scientific and technical progress. The rapid introduction in the national economy of the latest technologies is an integral component of the unified scientific and technical policy. At the June (1983) CPSU Central Committee Plenum it was emphasized that "the main means to a qualitative change in the productive forces is, of course, the changeover to intensive development, the combination in reality of the advantages of our socialist system with the achievements of the scientific and technical revolution. Moreover, of its latest stage, which promises a technological revolution in many spheres of production."[1]

The increase of the role of technological progress at the present stage of the development of social production stems from a number of factors. Let us name the main ones of them.

The development of fundamentally new types of equipment is becoming possible owing to the assimilation of specific technologies. Thus, the successes in the area of space rocketry and radio electronics to a significant extent are obliged to the achievements in the technology of metals, semiconductors, printed circuits and heat-shielding coatings. Progress in construction depends more and more on progress in technology.

The limitations of the further increase of the raw material resources and manpower, which are being committed to the economic turnover, along with the rapid increase of the cost of many types of raw materials are giving rise to the urgent need for the extensive use of resource-saving technologies.

Enormous possibilities of the improvement of technology have emerged owing to the scientific achievements in the assimilation of efficient physical chemical

processes of the conversion of substances and to the development of qualitatively new means of automation on the basis of microelectronics. They are making it possible to increase sharply the rates of processing, to use the modular principles of the organization of technology, to control technological processes and to change them over quickly when shifting to the output of other types of products.

Along with qualitative changes in the area of so-called classical technologies, which include machining and chemical processing, heat engineering and electrical engineering processes, such fundamentally new technologies as nuclear, laser, radio electronic, biological and space technology have appeared. The assimilation and extensive introduction of technological processes with the use of these methods of converting substances and energy, which arose relatively recently, promise significant gains in social production.

Technological progress is spreading in all sectors of the national economy. In power engineering the generation of electricity at nuclear electric power plants is increasing, the use of the energy of thermonuclear fusion is gradually approaching, magnetohydrodynamic technologies are being introduced, the direct conversion of thermal and nuclear energy into electric power is being assimilated, the energy of the sun and the world ocean and geothermal sources are being involved.

The methods of extracting and transporting minerals on the basis of the new technology of crushing rocks and methods of extraction with the use of thermal, mass exchange, chemical, hydrodynamic and biotechnical processes are being improved. Major changes are occurring in the methods of performing geological prospecting operations and seismic prospecting with the use of remote means of prospecting, including satellite-borne equipment.

Progress in chemical technology is making it possible not only to increase the properties of known, assimilated materials, but to come closer and closer to the obtaining of materials and substances with preset properties. A large number of hybrid and composite materials have already been developed. The practicable tasks of increasing the production capacity and the purity of the final product and decreasing the power-output ratio and the negative influence on the environment face chemical technology.

In ferrous metallurgy the rate of the introduction of the continuous teeming of steel and the production of electric steel is increasing, the technology of the direct reduction of iron, which is succeeding the blast furnace process, is being assimilated. Powder metallurgy, which ensures a significant saving of metal and the decrease of labor expenditures by 30-60 percent, is assuming great importance.

The nature of metalworking technology is changing. The rates of machining are increasing due to the use of more efficient tools. The proportion of the methods of hot and cold cubic deformation, welding and stamping is increasing with a decrease of machining. The methods of the surface hardening and increase of the wear resistance and durability of the parts and assemblies of machines by the application of special coatings are being used more and more

extensively. The use of machine tools with programmed control, machining centers and versatile automated production systems is changing in principle the technology of metalworking. Control computers and built-in microprocessor equipment are becoming a fundamental part of the technological equipment for the processing of metals and other construction materials.

A spindleless technology with the use of the pneumatic, aeromechanical and self-twisting methods of spinning, which makes it possible to increase its speed by several fold, is being introduced in light industry. A low-noise draw weaving technology is succeeding the shuttle weaving technology, the output of knitwear and the production of carpets by the taffeting method are being expanded.

In agricultural production all the basic types of technologies, which are used in plant growing and animal husbandry: mechanical, chemical and biological, are being improved. Owing to the use of powerful, completely equipped machinery and the development of fundamentally new types of it for animal husbandry, vegetable growing and fruit growing machine technology is changing, which is ensuring the decrease of the labor intensiveness and the increase of the effective output of products. The use of new types of fertilizers and highly effective chemical means of plant protection characterizes the progress in the chemical technology of agriculture. The breeding of new species of plants and breeds of animals on the basis of the methods of selection and genetic engineering is affording the prospect of the further significant increase of the productivity of agricultural production due to the use of the achievements of biological technology.

Technological progress is having such a profound influence on construction, transportation, communications and other sectors of the national economy. Since it is becoming a most important factor of the intensification of social production, the demands on its management and the improvement of its planning, organization and stimulation are also increasing.

The planning of the development of production technology is much more complicated than the planning of the products list and the volumes of output of products. Not physical and material items, but the processes of obtaining them, which it is more difficult to describe in quantitative plan indicators with the use of physical and value measurers, appear here as the object. At the same time the drafting of plans of the assimilation of introduction of advanced technologies is inseparably connected with the planning of the output and the modernization of technological equipment, accessories and tools, by means of which the technology is realized in production.

At the level of enterprises and shops the planning of the technological preparation of production and the introduction of advanced technologies has been mastered with respect to both methods and organization. At the sectorial and the national economic levels a scientifically sound method of drawing up the plans of technological development has not yet been formulated to the required degree. One of the reasons is the difficulty of the aggregation of the indicators of the assimilation of individual technological processes at enterprises into consolidated sectorial and national economic indicators, which for the present have not been elaborated thoroughly enough.

In spite of the procedural difficulties, the national economic planning of technological progress is continuously being expanded and extended. The indicators and measures in the area of the introduction of advanced technological processes are receiving greater and greater reflection in the procedural instructions of the USSR State Planning Committee and the forms on the drawing up of drafts of the basic directions of economic and social development for a 5-year period and the long-range future in accordance with the section "The Development of Science and Technology."

In the five-year plans of the development of science and technology there is a subsection, which contains assignments on the introduction of advanced technology and the mechanization and automation of production in the sectors of the national economy and is formulated on the basis of suggestions of the State Committee for Science and Technology, the USSR Academy of Sciences, the State Committee for Inventions and Discoveries, ministries and departments with allowance made for the comprehensive national economic programs and scientific and technical programs, as well as the purchase of licenses. The assignments on the assimilation of the most important types of technologies and technological equipment, which are being used in the USSR for the first time, the use of the most economical materials and the placement into operation of pilot industrial plants are included here. Such technological processes, which correspond to or exceed in technical and economic level the best world achievements and make it possible to solve the fundamentally new problems of the development of the sector, are singled out when selecting the measures.

Indicators, which characterize the broadening of the scale of the use of model technologies, standard adjustable machine tool attachments and standard adjustable and standard-unit equipment, have been introduced in the practice of planning scientific and technical progress.

The elaboration of methods and guiding documents in the system of standardization attests to the improvement of the planning and management of the development of production technology. Thus, the State Committee for Standards issued the Procedural Instructions on the Planning of the Indicators and the Evaluation of the Technical and Economic Level of the Technological Preparation of Production. Procedural recommendations on carrying out the certification of technological processes have been included in the documents of the unified system of the technological preparation of production (YeSTPP). The basic indicators of certification reflect their productivity, degree of economy, reliability, harmlessness and use of standard components.

At the same time the assimilation of new technological processes should be represented on a larger scale in the national economic plans. At present the extent of the planned introduction of new types of machines, instruments and apparatus comes to several thousand descriptions, while the number of technological processes being introduced is one-tenth to one-twentieth as great. By analogy with the used removal from production of obsolete types of products the indicator of the decrease of the level of the use of obsolete technologies should be introduced in planning practice.

The planning of progress in the area of technology is carried out mainly by the collection of the planning measures, which are formulated by enterprises, associations and ministers, and their combination, which to a certain extent is mechanical, within the sector, the republic and the entire national economy. This is responsible for tendency to implement measures "a little greater in number, a little smaller in scale." As a result the introduction of general-purpose technological processes with few operations and the development of the general sectorial and especially the intersectorial directions of profound qualitative changes in production technology are being checked. As an example it is possible to cite the technology of the production of nonwoven materials, the extensive dissemination of which depends on centralized influences and the coordination of the efforts of a number of ministries and departments.

Consequently, technological progress, which appears in the introduction of qualitatively new methods of obtaining and processing materials which are used in many sectors of social production, should be the object of planning at the national economic level. It is necessary to draft the plans of the implementation of such most important measures by the goal program method.

It is necessary to establish rational ratios between the different types of working. Thus, in machine building machining is too significant, while plastic metalworking is inadequate. As a result 15-20 percent of the metal ends up as chips, while in case of cold and hot extrusion and die forging the losses as one-fifth to one-third as great. Therefore it seems advisable to analyze the possibility of introducing in planning practice proportions or coefficients of the technological structure of production, which determine the share of the given technology in the total volume of working.

The proportion of each type of working can be calculated by means of physical and value indicators. In physical terms the share of the given type of working is determined by taking the ratio of the weight (volume) of the material, which is being worked by the given method, to its total weight (volume) or on the basis of the comparison with each other of the weights (volumes) of the materials being worked by different methods. In value terms the share of the given technology in the total volume of working is established by dividing the expenditures on working by the given method by its total cost. The coefficients of the technological structure should be determined with respect to each item, as well as at the level of the enterprise and sector. They could become plan indicators of the technological structure, which are established for various sectors in order to achieve an efficient combination of the technologies being used and to create a preference for those types of it, which ensure the greatest saving of resources.

The very limited set of indicators of the technical and economic level of technologies, which are used in planning, is far from perfection. Such local indicators as the rate and depth of cutting characterize only one aspect of the progressiveness of the technological process and are suitable only for a specific type of working. There is no universal, generalizing set of plan indicators of the technical and economic level of technology.

In our opinion, such a set could include three groups of indicators, which characterize respectively the ultimate effectiveness, the technical perfection and the universality and degree of use of standard components in technological processes.

Among the indicators of the first group are:

the labor intensiveness of the making of the product and the increase of labor productivity due to technological factors;

the share of the expenditures on working in the production cost and the decrease of the latter on the basis of the improvement of the technology;

the materials-output ratio of the product, the saving of material, fuel and energy resources, which is attainable as compared with less advanced technologies;

the time of the assimilation of the new technology and the technological preparation of production.

Included among the indicators of the second group are:

the speed, roughness and precision of working, which are calculated in universal measurers;

the intensity of working, which is determined by the relative volume, weight and surface of the material;

the waste-free nature of working, which is characterized by the proportion of the material which ends up as waste products (the utilization factor of the material).

The third group includes the following indicators:

the extent of dissemination of the technology;

the level of use of standard components of the technological process, standardized and standard technologies;

the proportion of standard adjustable and standard-union technological equipment;

the degree of use of standard and unified machine tool attachments.

The utmost intensification of item, part and assembly specialization and the expansion of intersectorial works, the level of which, especially in machine building, for the present is inadequate, are one of the ways of improving technology. The use at one enterprise of numerous and diverse types of technological processes in case of negligible volumes of operational working checks the development of highly intensive general-purpose technologies. The inadequate level of technological specialization is responsible for the small-series production by the handicraft method of varied accessories and tools and

the development of a kind of "internal" machine building in all sectors, which decreases production efficiency. Consequently, technological specialization should become an object of national economic planning, while its level should become one of the criteria of the evaluation of the quality of the economic operations of enterprises, associations and ministries.

The level of specialization of shops, sections, enterprises and associations can be estimated from the number of used types of technologies and methods of working materials. For this purpose a detailed catalogue of the descriptions of technological processes and methods of working should be drawn up, on the basis of the classification of their types, which was adopted in the standards of the unified system of the technological preparation of production. Such a catalogue or classifier will make it possible to establish the number of used technologies and by means of specially devised tables or coefficients to determine the level of technological specialization, which subsequently should become a plan indicator.

The problem of technological progress is inseparable from the problem of the structure, efficiency, technical level and quality of the technological equipment, which is being produced and used in the national economy, accessories and tools, without which the introduction of advanced resource-saving technologies is inconceivable. Highly efficient equipment creates the physical and material base of technological processes and serves as one of the main conditions of their improvement.

The interconnection between the development of technology and equipment appears most fundamentally in machine building, in which in recent years revolutionary technological changes have been planned and are being implemented in practice. The changeover to versatile automated technological processes is ensuring, on the one hand, the possibility of the working of broad groups of similar items by means of readjustment and, on the other, the decrease of the number of machine tool operators, who are engaged in manual or monotonous labor, and their replacement with skilled adjusters. The implementation of this main direction of technological progress in machine building lies through the use of NC machine tools, robotics, automatically adjustable modules and lines and versatile automated production systems with built-in microprocessor equipment. The planning of the output and practical assimilation of this fundamentally new equipment with the observance of the comprehensive, systems approach and the implementation of the necessary organizational and technical measures, which ensure its efficient use, is one of the most important conditions of the qualitative transformation and automation of technological processes in machine building.

In analyzing the interconnection of technology and equipment, let us note one very important circumstance. Although technological progress is impossible without the use of the corresponding equipment, technology, that is, the progressiveness of the selected means of working, should be the primary, master unit in it, while the means of implementing this method are called upon to ensure its practical realization. Unfortunately, in case of the planning of the production and purchases of technological equipment the kind and type of equipment, and not the technology realized by means of it, frequently serve as the starting point. Given such an approach the latter then has to be

planned to fit the equipment, as a result of which obsolete methods of working materials exist at times in production. Therefore the principle of the planning of equipment to fit the technology should become one of the rules of the drafting of national economic plans.

The introduction of new advanced technological processes requires a preliminary pilot check and experimental development. Consequently, the development of scientific research of the technological type and the expansion of the pilot experimental base are a most important task. In conformity with the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy" when drawing up the drafts of the five-year (for 1986-1990) and annual plans of economic and social development it is necessary to outline a set of measures, which are aimed at overcoming the lag in the establishment and technical equipment of pilot and experimental bases and works, and to identify the reserves of capacities for the timely preparation of production.

The acceleration of technological progress in many ways depends on its planning and management, the methods and organization of material and moral stimulation. The prevailing moral priorities, economic stimuli and levers do not satisfy to an adequate extent the requirements of the rapid introduction of the achievements of technological progress.

The trend toward a certain priority of the problem "what is to be done" over the problem "how is it to be done," which found reflection in the primacy of the structure and amounts of the output being produced and the designs of items with respect to the technology of their production, formed historically in the development of the economy. It is also understandable, since in the end society needs products which meet its needs, the method of obtaining them is only a means of the achievement of the goal, which without apparent detriment to the consumer can be concealed within the production process. For a long time the types and properties of the products being produced embodied a form of the manifestation of scientific, technical and even social progress. The steam engine, the internal combustion engine, the electric motor, the rocket engine, the nuclear reactor and the computer marked the stages of the scientific and technical revolution and the roots of the industrial revolution. Energy-converting, transportation, chemical and information machines became a symbol and the embodiment of progressive changes in the nature of production, a condition of deliverance from different physical labor and a means of increasing the efficiency of the use of economic resources.

Of course, the victory march of new equipment was accompanied by revolutionary changes in the area of technology, without which it would have been impossible to develop new machines. However, technology for the most part followed equipment.

The priority status of the design, type and composition of products with respect to the methods of their production found reflection in the formation of a scale of values, which in many of its traits has been preserved to this day. The secrets of the design and the plans were protected most carefully and served as the main subject of inventions; the development of new models of products was regarded as the basic criterion of the increase of the technical

level of production and scientific and technical progress as a whole. The names of prominent designers and managers of planning and design collectives are uttered in the aura of lofty titles and positions, which process engineers, for whom the position of chief plant process engineer serves as the ceiling, do not receive. Planners and designers receive academic degrees, honorary titles and awards more often than process engineers. All of this should be spoken about not for the purpose of belittling somehow the role of famous designers and exhalting process engineers, which the latter, however, deserve. This is a question of something else.

In recent years the changes in the evaluations of the relative importance of design and technology have become more and more noticeable. The pan of the scales has gradually begun to dip in favor of technology, the role and the relative and absolute value of which in social production are increasing immeasurably, to which many facts testify. The secrets of technology are now valued and protected throughout the world more than are the secrets of design, the demand for advanced technology has increased, it is winning more and more the place of the most valuable object in international trade and scientific and technical exchange, the flow of patents and licenses of a technological nature has increased sharply.

The causes of the "technological boom" in the world economy are obvious and clear. The practical implementation of plans has begun to be checked by economic possibilities, limitations in manpower, material, raw material and financial resources and the increase of the cost of raw materials. Therefore the aspiration is arising for the search for, selection and implementation of efficient plans and technical decisions, which make it possible to achieve the desired result with the minimum expenditures of resources, including the main resource of the economy--time. The final say has begun to rest with technology.

Advanced technology is needed today not only in the sphere of physical production, but also in the sphere of nonproduction services, scientific research, data processing and the formulation of administrative decisions.

Meanwhile the practice of the management of social production and scientific and technical progress and the system of stimulation, which is used in it, react slowly to occurring changes and inadequately promote the development of technology, which is complicating the changeover of the economy to the path of intensification. In planning and management organs the drive for product quality is often confined to the introduction of new indicators, standards and instructions, which in themselves, without a radical improvement of technology, are not capable of increasing the technical level, quality and reliability of items.

Technological problems should hold a leading place in the state plans of scientific research work and the comprehensive scientific and technical programs of the five-year plan. Intersectorial centers for the development and use of general technologies should be formed for the extensive introduction of general-purpose technological processes of intersectorial application.

It is expedient to enhance the role of technological services and technological monitoring services at enterprises. The functions of the chief process engineer of the enterprise and technological bureaus should not be limited to the development of traditional technological processes and the keeping of documents, their activity must be equally aimed at the assimilation of fundamentally new technologies.

It is necessary to improve the system of the remuneration of the labor of personnel of the technological type and the stimulation of the development and introduction of highly efficient, low-waste, economical technologies. It is advisable to raise the wage of process engineers to the same level as design engineers. Such a right has already been granted to the five Leningrad associations, which are conducting an experiment on the improvement of the organization and remuneration of the labor of designers and process engineers. The establishment of the salaries of 278 process engineers of these associations at the level of the salaries of design engineers of the corresponding categories made it possible to increase the interest and responsibility of the personnel of the technological services in the improvement of the indicators of the activity of the associations.

In our opinion, indicators, which characterize the level of the used technological processes and are determined in accordance with the results of certification, should be introduced among the fund-forming indicators, which determine the amount of the material incentive fund which is formed from the profit of the organization.

It is of no small importance to increase the prestige of the specialty of process engineer, to increase the quality of the training of specialists in the system of higher and secondary specialized education and to broaden and intensify training with allowance made for the main directions of current technological progress.

The development of technology as a component of social production and the improvement of its planning and management require significant efforts and expenditures, but they will be repaid many times over by the increase of efficiency and product quality and the more complete and better meeting of the needs of the people.

FOOTNOTE

1. "Materialy Plenuma Tsentral'nogo Komiteta KPSS, 14-15 iyunya 1983 goda" [Materials of the CPSU Central Committee Plenum, 14-15 June 1983], Moscow, Politizdat, 1983 p 10.

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CSO: 1814/74

ORGANIZATION, PLANNING AND COORDINATION

INTRODUCTION OF SIBERIAN DEPARTMENT'S DEVELOPMENTS IN INDUSTRY

Moscow IZVESTIYA in Russian 30, 31 Jan, 1 Feb 85

[Article by IZVESTIYA science commentator B. Konovalov: "Stores of Intelligence and Knowledge"]

[30 Jan 85 p 2]

[Text] 1. The Thorny Path of Progress

Academician P. L. Kapitsa 20 years ago accurately observed that the very word "introduction" signifies the penetration of science into some alien resistant environment, and proposed to use the term "assimilation." Alas, the past years have not changed the situation, as before the word "introduction" reflects more accurately the nature of the advancement of science into the national economy. On the average this stage for the present takes 8-10 years. Therefore it is important to understand what factors give rise to "resistance" to scientific and technical progress.

Today we are tracing the path of the developments of academic science--the most advanced detachment of scientists--on the basis of the example of the Siberian Department of the USSR Academy of Sciences, which was founded 27 years ago. Not only a high level of basic research, but also a large number of applied operations are characteristic of the young Siberian Department. Here more than a third of the total amount of development is being performed on an economic contractual basis and has a practical orientation.

In September 1984 a special exhibition of the practical achievements of the institutes of the Siberian Department of the USSR Academy of Sciences was organized in the USSR State Planning Committee for the workers of ministries and departments. The USSR State Planning Committee on the threshold of the next five-year plan also held earlier such exhibitions of various scientific centers. But their point was primarily for demonstration: see what will appear valuable, take it and introduce it. The ministries took only a little. And the developments became obsolete, never having received mass application. Unfortunately, among the 184 developments, which are now being proposed for extensive copying during the new five-year plan, there were also such ones which have "migrated" from the exhibition which was held 5 years ago.

No matter how paradoxical, there are interesting developments, which arose back at the "dawn" of existence of the Siberian Department, received a high rating during testing under industrial conditions, but so far have not found proper mass application. Thus, more than 20 years ago at the Institute of Catalysis under the supervision of Academician G. K. Boreskov ferric iron-molybdenum catalysts in place of expensive silver catalysts were developed and the process of the synthesis by means of them of formalin--one of the important products of the chemical industry--was devised. In 1965 the first domestic reaction vessel, which operates on this catalyst, was started up at the Novosibirsk Chemical Plant. The need for silver declined and, moreover, about 50 kg of methyl alcohol were saved per obtained ton of formalin. In general, the new technology per ton of formalin saved a minimum of 3-5 rubles, which given the existing scale of production in the country could have provided a profit of many millions of rubles. But, alas....

The head institutes of the ministries, which are responsible for some directions or others, in practice fully determine the technical policy in the sector and the prospects of introduction. This is understandable. Specialization is necessary. The concentration of forces is needed. And many head institutes are doing very important work for the country. But the monopoly "ownership" of enter scientific and technical trends intentionally or not leaves a mark of the head organizations. If some work originates elsewhere, they are included to regard this as an encroachment on their prestige. And thousands of arguments are found to demonstrate that the others' development is "crude," unprofitable, unreliable and so on and so forth. The head organization in the person of the Novosibirsk Affiliate of the Kemerovo Scientific Research Institute of the Chemical Industry of the Kemerovo Karbolit Scientific Production Association is continuing to press silver catalysts, although during these years the development of the Institute of Catalysis has already been implemented in Bulgaria and Czechoslovakia. Recently one of the firms of the FRG, having made a comparative analysis of various oxide catalysts of different countries of the world, including the iron-molybdenum catalysts which were developed in Novosibirsk, deemed them the best. But so far they are being used in our country only at small units of two plants--in Novosibirsk and Gorlovka.

"All happy families are similar to each other, every unhappy family is unhappy in its own way," L. N. Tolstoy said. This also applies to the fates of scientific developments. As a rule, the "happy" ones are those which help enterprises to fulfill the plan more easily, to decrease the labor expenditures and materials and to improve product quality without the significant reorganization of production. "Unhappy introduction" has a large number of causes. Beginning with such purely subjective factors as the obstinate character of the author of the development or a poor report to the minister, and ending with very serious and objective factors. One of the typical causes of "unhappy introduction" is the barrier of the head organizations. The lack of the possibility of the competition and extradepartmental evaluation of developments has the result that given competing proposals the "right of the strong," and not the real merits of an innovation, often automatically works. Unfortunately, with the years the situation has not improved significantly. Moreover, this is also observed

where, it would seem, there is an urgent need for efficient domestic technology.

It is interesting that wherever in the sectors there is no powerful head organization, which is responsible for the development of a new direction, the introduction of the results of academic research occurs much more rapidly. For example, the transient catalytic methods, which were devised by the Institute of Catalysis and make it possible to obtain sulfuric acid from the harmful discharges of enterprises of nonferrous metallurgy, are being successfully developed. The technology is quite simple and does not require additional energy expenditures. And units for this purpose are already now being set up an many enterprises of the Ministry of Nonferrous Metallurgy. The plants are making them themselves at the expense of the assets for capital repair in accordance with their own plans. It is recommended by an order of the minister to use this know-how extensively at the enterprises of the Ministry of Nonferrous Metallurgy. The country will obtain compounds of sulfur from the exhaust gases of plant units instead of spending assets on the increase of its extraction from natural stores. At the same time one of the serious ecological problems is also solved.

The stores of intelligence and knowledge are no less important wealth than the natural resources of the country. But these "stores" will become real wealth only if they are used efficiently for the good of our people.

Academician M. A. Lavrent'yev, the organizer of the Siberian Department of the USSR Academy of Sciences, always believed that it is necessary to fundamentally combine basic research with applied research. It was decided to create around the Novosibirsk Academy Campus a "zone of introduction"--a network of design bureaus of various ministries, which would immediately, without intermediate instances take up the torch of valuable developments of academic institutes and promptly use the achievements of scientists in their sectors. For the realization of this idea the subordination of all design bureaus should have become dual--to the ministry and to the Siberian Department in the person of the "parent institute."

Each of the partners hoped to derive benefit for itself. The Academy of Sciences did not have the assets to establish its own powerful planning and design base--the "lion's share" of the allocations for the development of science go to the ministries, and it was tempting to use them to some extent. Siberian scientists hoped that each design bureau would be a kind of "Trojan horse," by means of which they would be able to penetrate the sector and, by engaging only in their own professional business--research, without any trouble and torments to turn over valuable results to the national economy. The ministries also began to regard such design bureaus as a "Trojan horse." They obtained the opportunity to use free of charge the achievements of scientists, were located on improved grounds, where heat supply systems, a water supply line, a sewer system and other benefits of civilization had already been set up, and, moreover, there was the opportunity to "drain off" skilled personnel from the Academy Campus for their own sector.

As they say, a marriage of convenience was contracted. But it did not live up to the great hopes which were placed in it by the Siberian Department.

The main reason is that a simple and ancient principle comes into action: "Whoever pays, also orders the music." And the ministries, rather, their main administrations and all-union industrial associations are paying. The majority of them have the clear aspiration to turn the Novosibirsk design bureaus into purely sectorial organizations. The main goal--the introduction of the achievements of academic science--is being accomplished without spirit.

Academic science is very dynamic, while its results in most cases are of an intersectorial nature. As new "hot" directions are identified it redistributes its forces. The appearance of new results changes the nature of the needs for experimental design studies. Sectorial organizations owing to their specific nature are aimed at the directions which have been strictly specified by the ministry. The system of material stimulation also holds them back from the reorientation of operations--in an already developed area it is possible to guarantee the fulfillment of themes on time and the receipt of a bonus. Why take risks and undertake some new directions, even though they are very important, but the success of which is not guaranteed? As for interdepartmental problems, here in general it is extremely rarely possible to achieve mutual understanding.

Academic science needs an experimental design and experimental production base of intersectorial orientation, which can be quickly reorganized, but this is not characteristic of the latter aspect. This circumstance inevitably undermines the principle of dual management and leads to the turning of the organizations of the "zone of introduction" into organizations of sectorial science. Hence there also arose the tendency to turn them into sectorial institutes. Of the 11 established design bureaus of the "zone of introduction" 3 have already become institutes.

Thus, back in 1972 the Gidrotsvetmet Institute [not further identified] was organized on the basis of the Ekstraktsiya Special Design Bureau, which was set up by the Institute of Inorganic Chemistry. The direction founded by the Novosibirsk scientists proved to be very important, and the former design bureau became the head one in the Ministry of Nonferrous Metallurgy for the processes of hydrometallurgy. Here they had already rejected the initial arrangement of cooperation: the academic institute--the daughter design bureau. Gidrotsvetmet is cooperating extensively with many institutes of the Siberian Department. There is nothing bad in such "regeneration"--the factor of growth should also lead to this. But the trouble lies in something else--the expansion of the research portion is occurring rapidly, while technological operations are being developed extremely slowly. At present at Gidrotsvetmet 235 associates work in the laboratories, while only 60 work in the 2 pilot shops. The enormous rooms with 6-m ceilings, which were designed for pilot industrial units, are occupied by ordinary laboratories.

According to general opinion, the Energokhimmash Special Design Bureau of the Ministry of Chemical and Petroleum Machine Building is the best in the "zone of introduction." It arose and is being developed under the supervision of the Institute of Thermal Physics. One of the directions, which is being elaborated by joint efforts under the supervision of Corresponding Member of the USSR Academy of Sciences M. F. Zhukov, is multisectorial plasma

technology, which is of enormous national economic importance. But in the necessary triad: "the institute--the special design bureau--the pilot works" among them the last unit is missing. They are producing the basis of the bases--the plasma generator, the equipment for the new technology, in essence under semiprimitive conditions, there is no possibility to test it thoroughly. Now with enormous difficulties the special design bureau and the Institute of Thermal Physics are constructing with their own resources and on their own a building for the plasma center. But the "zone of introduction" was conceived precisely so that such difficulties would not exist for academic institutes.

That is why, without rejecting cooperation with sectorial design bureaus, the Siberian Department began also to seek other means of introducing its developments. Fruitful cooperation in accordance with long-term coordinating plans and programs of joint research and introduction has already been organized with approximately 20 ministries and departments. The work within state goal programs, especially such a major one as the Siberia Program, which is aimed at the rapid development of the productive forces of the region, as well as developments in accordance with direct contracts with enterprises have acquired extensive scope. And it is natural that in those directions, in which good business relations are forming, cooperation with the sectors is growing stronger and is expanding.

In Novosibirsk itself the work of all the scientific institutions of the city is directed by the Council for Scientific and Technical Progress of the oblast committee of the CPSU, which A. P. Filatov, its first secretary, heads. At the enterprises of this largest industrial center of the country the scientists of academic institutes have introduced many tens of developments, which are yielding a large economic impact and are contributing to the intensification of production.

The enormous importance of this work is obvious, but the narrow framework of such "local introduction" is also clear. Let us see how the fate of a development in this direction forms, on the basis of the example of the promising laser technology which is being developed by the Institute of Automation of Electrometry.

In 1976 at the Novosibirsk Tyazhstankogidropress Plant imeni Yefremov a group of scientists of the institute, which was headed by Candidate of Technical Sciences V. P. Koronkevich, introduced a laser interferometer, which is designed for the measurement of movements with an accuracy of a tenth of a micron per meter. This is important for the control and adjustment of machine tools. The adjustment by means of such an instrument of a machine tool with a length of the slide guides (over which the machining tool moves) of 16 m takes approximately an hour instead of the 2 days which were previously required given the former methods which, moreover, did not ensure the necessary precision.

But this is only one of the directions of the use of the new measuring tool, in which the length of a wave of laser radiation is the modulus of precision. For precision machine tool building this is all the same as the use, say, instead of a simply magnifying glass of an electron microscope is for biology. The foreign firm of Hewlett Packard, which specializes in this field,

incorporates its instruments in 36 types of series-produced machine tools and production lines, in this case the laser measurer is used directly in the process of machining parts.

We do not have machine tools with built-in laser measurers of dimensions. The reasons, in the opinion of the head institute of the Ministry of the Machine Tool and Tool Building Industry--the Experimental Scientific Research Institute of Metal-Cutting Machine Tools--is simple: the Ministry of the Electronics Industry for the present is not producing lasers which could operate reliably under plant conditions. Because intersectorial development proceeded according to the usual scheme: the head organization issued an assignment to the related ministry, the latter was not able to cope successfully with it. The Experimental Scientific Research Institute of Metal-Cutting Machine Tools criticizes the related industries and does not feel any blame.

But how did the Institute of Automation and Electrometry act? It developed itself a quite reliable laser.

Could the Experimental Scientific Research Institute of Metal-Cutting Machine Tools have done this? No. The necessary specialists for this are not there. Thus, one would like to know, why ought precisely it to have assigned the new matter, while obviously knowing that it would drag on for long years?

Recently the laboratory of V. P. Koronkevich introduced at the Novosibirsk Metallurgical Plant imeni Kuz'min a laser measurer for the control of the speed of the rolling of pipe. The laser instrument efficiently follows the movement of the pipe, which rushes along at a speed of 4 m a second, and issues a command for the precise cutting off of 8-m "strings." The system operates excellently in the hot metallurgical shop. Its merits are obvious. But when will it become accessible to all rolling shops and plants of other sectors?

Unfortunately, as was noted at the applied science conference recently held in Novosibirsk, the introduction of the achievements of science, as a rule, is of a local nature. For the present 80 percent of the new developments are being introduced only at 1 enterprise, less than 20 percent at 3-4 and only 0.6 percent at 5 works and more. It is impossible to consider such a situation normal. And if we are not able to change this situation, the hopes for the radical and quick increase of labor productivity by means of scientific and technical progress will remain only hopes.

[31 Jan 85 p 2]

[Text] What Is the Academic Institute to Be?

The point of the existence of academic science is the conducting of basic research and the obtaining of knowledge, on the basis of which fundamentally new scientific and technical trends or efficient technologies, which immediately increase labor productivity tens and even hundreds of times and change the very nature of labor, can arise. It is not power engineering that gave rise to nuclear power stations, but physics. It is not the Central

Statistical Administration that invented the computer, but mathematicians. Lasers originated not at the institutes of the electronics industry, but at the Academy of Sciences.

The best forces, the best "minds" are now concentrated precisely at the academy. But how is this potential being used? Does the yield of academic science correspond today to its possibilities? Hardly anyone will venture to give an affirmative answer to this question. There are objective factors which are preventing academic institutes from fully utilizing their potential. And first of all this is the very structure of the institutes, which is aimed mainly at the conducting of research, and not at the use of its results.

Today the academic institute, which wants to work actively for the national economy, is in a very difficult position. Let us take, for example, the Institute of Catalysis of the Siberian Department of the USSR Academy of Sciences. The institute is a powerful one, the leading one in the country for catalytic processes. And not only in the country. The Coordinating Center of the CEMA Member Countries for Industrial Catalysts is located here. The many years of work of the institute have constantly provided an economic impact of millions of rubles. There is a subsidiary special design and technological bureau of catalysts of the Ministry of the Chemical Industry, which helps to introduce some research of the institute, but mainly along the lines of its sector. But many valuable developments are of an intersectorial nature.

At the Institute of Catalysis they are now developing methods of obtaining synthetic liquid fuel. It is possible to obtain high quality gasoline directly from natural gas or gas condensate. This has already been done at laboratory-scale plants. Now it is being done at pilot plants. It is not necessary, apparently, to spend a long time explaining, of what enormous importance for the country the implementation of this scientific idea is. The institute has concentrated the basic forces of its machine workshop on the establishment of two pilot industrial plants. But, of course, to the detriment of all the other laboratories, the research of which today may prove to be no less important. The institute consciously agreed to these sacrifices, understanding the enormous state importance of the matter. But why, one would like to know, should it be carried out under primitive conditions?

There are only about 20 workers in the machine workshops for the 900 associates at the Institute of Catalysis. The ratio at many other academic institutes is also approximately the same. Just as it formed at one time in the 1920's, so these norms have been ossified to this day. But it is now the 1980's. The age of the scientific and technical revolution, when science is giving rise to ideas which are causing genuine radical changes in many sectors of industry.

At the Siberian Department there is a good example of the development of academic science in combination with the solution of production problems--the Institute of Nuclear Physics. This institute is the recognized world leader in operations on double clashing-beam accelerators. The institute is developing a very important and untraveled path in the area of thermonuclear

research. And at the same time it is producing commercial accelerators for the national economy.

This institute is distinguished from the other institutes of the Siberian Department, within which there are their own design bureau and pilot works, by the power of the latter, which also enabled it to become a organization which actively introduces in production not some isolated development, but an entire vast direction--radiation technologies. A number of commercial accelerators have been developed here. The institute makes them at its own experimental works and together with sectorial organizations of ministries and departments sees the matter through to the development of an operating technology. Now more than 70 commercial accelerations of the institute are already in operation in various sectors. Their use for the increase of product quality just on the production lines for the output of cables at enterprises of the Ministry of the Electrical Equipment Industry provided an economic impact of more than 120 million rubles. The radiation technology of disinfecting grain by means of the Novosibirsk accelerators was developed at the Odessa Grain Elevator. It will be used at the Volgodonsk and Tallinn grain elevators. There are gains in many other directions.

At any moment the Institute of Nuclear Physics is ready to transfer the documents and technology for the series industrial production of accelerators. It will not remain "unemployed": many promising directions have already been outlined, for example, the use of synchrotron radiation of the former purely scientific plants--the "accumulation rings" of electrons. As a whole the institute expends on applied operations only a fourth of the total efforts, but earns several fold more money than it receives in accordance with the budget of the Siberian Department, and in essence basic research is being developed here on these assets.

Of course, not necessarily all academic institutes should be like the Institute of Nuclear Physics, but they should have without fail the opportunity to quickly change a fruitful idea into a pilot unit, an experimental technology.

Having understood long ago that it is impossible to rely entirely on the "zone of introduction," the Siberian Department began to set up a network of its own design bureaus. These cost account academic design bureaus are aimed at the implementation of the scientific ideas of their "parent" institute, but at the same time do a certain portion of the work for other institutions of the Siberian Department. At present there are already seven such design bureaus. They are helping significantly to equip the institutes with nonstandard equipment and are facilitating the process of introducing scientific achievements. But still this does not completely solve the problems of introduction. The most important task of the next few years is the further development of the design and especially the pilot production base.

For the present for the 55 institutes and 7 design bureaus in the Siberian Department there is only 1 pilot plant, which produced products worth approximately 10 billion rubles a year. Can this Novosibirsk plant also meet the internal needs of the institutes of the Siberian Department and produce all the prototypes necessary for introduction? Of course not. It is not

capable of coping with such an amount of work, and this is hindering the implementation in practice of new instruments, machines and units which have been developed by scientists.

Precisely for this reason pilot production is being expanded at other Siberian scientific centers. In Tomsk, for example, the construction of a large design and pilot production base of optical instrument making is being completed, which will enable the Institute of Atmospheric Optics and a number of other organizations to ensure the output of small batches of the unique instruments and units, which are being developed by them.

The Siberian Department has accumulated an enormous scientific and technical potential of research which is necessary for the national economy. Scientific technical associations (NTO's) may become one of the means of the rapid transfer of its results to practice.

Thus, the Institute of Automation and Electrometry today has a unique amount of technologies--electronic, optical and laser, and much experience in the development of computer hardware and items with very fine mechanics. As a rule, some ministry specializes in each of these technologies--but here everything is under one roof. The establishment of a scientific technical association would enable the institute to speed up the implementation of valuable intersectorial developments.

At present the Presidium of the Siberian Department of the USSR Academy of Sciences is completing the study of the question of setting up the Avtomatika Scientific Technical Association on the basis of the Institute of Automation and Electrometry and the special design bureau of scientific instrument making. The establishment of another scientific technical association is planned--in Tomsk on the basis of the integration of the work of the Institute of Atmospheric Optics and the Optika Special Design Bureau with a pilot works.

At present it is very difficult for academic developments to pass through the stage of the initial demonstration of their fruitfulness. When deciding the question about the fate of an innovation they are usually interested in where it was tested under production conditions, because they already know everything: a laboratory-scale plant is one thing, an industrial plant is another. The system of scientific technical associations or some other form of the organization of academic science, which is similar to it, would make it possible to pass more quickly through the stage of demonstration--to produce new equipment and technology on its basis in small batches for testing under the conditions of real production and competitive tests if necessary. After this the successful development would have already itself voted in favor of itself and it would be possible to transfer it to plants for production on the scale which is dictated by the needs of the national economy. True, it is necessary to note that this is not a panacea for all "diseases of introduction."

Today the framework of basic research alone does not satisfy many academic institutes, they want to actively contribute to the acceleration of scientific and technical progress in the country, and it is necessary to form such a structure of scientific institutions, which would promote this.

Economic experiments are already under way in several sectors, and their scale is expanding. So why not also organize experiments in the sector "Science and Scientific Service," which is extremely important during period when the economy is proceeding to the path of intensive development? At present more than 4.5 million people are employed in our country in the sector "Science and Scientific Service." For some reason many people are inclined to regard the design bureau and the pilot works as a service of science. But in reality this entire sector is nothing other than the scientific service of the national economy.

One of the basic causes of the slow advance of academic developments (just as those of higher educational institutions) into production is the low capacity and, in many cases, the lack of a design base and a pilot works. Due to this institutes often are not able to bring their ideas up to a level which would be acceptable for industry. And precisely owing to this a fourth of the developments of the Siberian Department of those presented at the exhibition in the USSR State Planning Committee could not be accepted for extensive introduction.

Therefore one of the main questions, which the management of the Siberian Department posed for the USSR State Planning Committee and the USSR State Committee for Science and Technology, is the need for the significant strengthening of the design and pilot production base. This request of Siberian scientists was supported. During the coming five-year plan the situation should change, if in addition to the resources being allocated it is possible also to ensure the timely performance of construction operations.

This will help to fulfill the most important task which was posed by General Secretary of the CPSU Central Committee and Chairman of the Presidium of the USSR Supreme Soviet Comrade K. U. Chernenko--"to mobilize the organizational efforts and physical assets, which are necessary for the quickest retooling of all the sectors of the national economy, for the quick production assimilation of the most advanced technologies."

[1 Feb 85 p 2]

[Text] 3. The Plan Is the Head for Everything

The exhibition of the developments of the Siberian Department of the USSR Academy of Sciences, which was organized in the USSR State Planning Committee on the threshold of the new five-year plan, differed from all the preceding "previews" of this sort. This time it was not simply a demonstration of innovations--look and take, but an important component of the control of the state conveyor of introduction. The majority of presented developments were not simply the results of laboratory research, but a matter which had already been tested in practice. Their further fate had to be determined, the scale of use had to be outlined. With respect to each development the appropriate ministry, the USSR State Committee for Science and Technology and the departments of the State Planning Committee should have stated their opinion.

On the one hand, they did not offer the national economy "a pig in a poke," while, on the other, the scientists had the opportunity to defend their point

of view. The Collegium of the USSR State Planning Committee could be the judge in controversial questions.

Chairman of the Siberian Department and Vice President of the USSR Academy of Sciences V. A. Koptyug and A. I. Chubarenko, chief of the Consolidated Science and Technology Department of the USSR State Planning Committee, who was responsible for the organization of the exhibition, were satisfied with how it was held. Three-fourths of the presented developments were accepted for extensive copying. In all 32 developments were recommended for inclusion in state plans, 82--in sectorial programs and 39--in comprehensive goal programs.

What developments do ministries take most willingly? Against what are they trying to defend themselves? These questions are of great importance for not only the fates of Siberian developments, but also all scientific and technical progress.

The analysis made by the Siberian Department shows that ministries use more willingly developments which make it possible to decrease the labor expenditures and to save materials and fuel and energy resources without the radical reorganization of production. Moreover, they are trying not to include such technical innovations in state plans, in order to dispose of the achieved saving at their own discretion.

As compared with a purely academic development the innovations, in the development of which an interested enterprise, a sectorial scientific research institute and the ministry itself, which included them in the coordinating plans of joint work with the Siberian Department, took part at an early stage, make their way more easily into big life.

Ministries take most willingly the operating prototypes of machines and devices, which have been produced by the developers and which simultaneously both are undergoing testing and are helping here the enterprises to fulfill the production plan. But the ministry agrees to mass production if the innovation serves first of all its sectors. And not always. For example, two industrial prototypes of a machine for the crushing of large pieces of copper-nickel intermediate products of metallurgical production, which was developed at the Institute of Hydrodynamics and the special design bureau of hydraulic pulse equipment of the Siberian Department of the USSR Academy of Sciences, since 1983 have been in operation at the Severonikel' Combine. But it took much trouble to convince the ministry to produce during the next few years if only a small batch of such machines for internal needs.

If the entire burden of organizing the production of new equipment falls on one ministry, while several others should use it, thousands of "reasons," which hinder the matter, are found. Everyone usually agrees to use an intersectorial development, but each tries to "dump" the organization of its production on another. As a rule, it turns out that the developer himself should coordinate the interests of the different departments, find a client-producer, determine the possible "sales market" and organize official orders for the reason that "the rescue of drowning people is in the hands of the drowning people themselves." Of course, this takes a large amount of efforts and time, and often the academic institute or the management of the Siberian

Department is simply not capable of handling this task. Wherever the ministries are not aware of their own advantage, they dig in, as they say, both their hands and their feet. But the prevailing economic levers of the advancement of new equipment work poorly.

During the first "round of talks" with the ministries and departments, which began long before the exhibition, to its many suggestions the Siberian Department, in spite of the endorsement of the departments of the State Committee for Science and Technology, received in essence formal relies. Both rejections and evasive wordings: "It is difficult to say about the scale of introduction," "requires further study," "for the present the ministry does not have the industrial technology," turned up in the responses. The sectorial departments of the USSR State Planning Committee, being to a certain extent an extension of the staff of the ministries, in many cases simply confirmed their position. Most often in controversial cases the reply was: "we agree with the opinion of the ministry."

But after several "rounds of talks," the visiting of the exhibition by workers of the USSR State Planning Committee, ministries and departments and by prominent state figures and the holding of a collegium of the USSR State Planning Committee, which took an active and demanding position, the situation changed. Many controversial questions were settled, and the ministries themselves as a result of repeated discussions identified significantly more developments of interest to them than at the preliminary stage.

The Ministry of the Chemical Industry, for example, is accepting a wide range of developments for implementation in 1985 and during the 12th Five-Year Plan.

Very long talks took place with the Ministry of the Chemical Industry on the renovation of the Novosibirsk Chemical Plant and its transformation into the base enterprise of radiochemical processes, which use the commercial accelerators of the Institute of Nuclear Physics. The Novosibirsk physicists have long been ready to work side by side with the chemists and to contribute to the organization of the production of radiation-modified polymeric materials, which the country needs very much. A paradoxical situation formed--the Institute of Nuclear Physics on the basis of its accelerators helped to set up such production in Poland, but at its place, in Novosibirsk, it did not turn out. The ministry seemed not to have objected, but at the same time did not made a decision. Now such a decision has been made, and it is a matter of carrying out the renovation as quickly as possible.

It turned out that it is possible to use state levers of control for the determination of the sales market of new equipment, but not to force the developers themselves to deal with this. The Gidroskop geophysical instrument, which was developed by the Institute of Chemical Kinetics and Combustion, can serve as an example. This is a complicated modern device, which makes it possible directly from the surface to a depth of 100 m to determine without drilling whether there is water under the ground. This device is unique. For the present there are no analogues in the world.

Associates of the Institute of Chemical Kinetics and Combustion on their own made several Gidroskop devices and tested them under various conditions. In

2 months of work in the northern part of Tyumen Oblast they found that at 150 planned sites of drilling for water it is not under the ground. They found sites where it is and drastically shortened the length of many planned water lines. The economic impact during the 2 months of this work is 3.9 million rubles.

This device can be used in the interests of many departments. The Ministry of Geology was ready to become a user, but did not undertake its production, the Ministry of Instrument Making, Automation Equipment and Control Systems also considered this device not to be characteristic of itself. But as a result it was planned that the Ministry of Geology will organize the interdepartmental tests of the Gidroskop and determine the need, while the Ministry of Instrument Making, Automation Equipment and Control Systems should set up the production of the devices in conformity with the obtained results.

The fate of many other intersectorial developments, particularly the electromagnetic hammers for the "driving" of piles, which were developed by the Institute of Mining and the special design bureau of applied geophysics of the Siberian Department of the USSR Academy of Sciences, was also successfully decided. They are simple and technologically effective in production and are productive. During the construction of offshore oil field platforms in the Chernomorneftegazprom Production Association such a hammer in the month of operation fulfilled 1.5-fold the annual norms of the traditionally used means.

According to the estimates of the developers, the need of the country for such hammers is 1,000 a year. The Ministry of the Gas Industry, the Ministry of the Petroleum Industry, the Ministry of Construction, the Ministry of the Gas Industry and other ministries are interested as users in the production of electromagnetic hammers, but no one wanted to be the producer [as published]. It was recommended by a decision of the USSR State Planning Committee to the Ministry of the Electrical Equipment Industry and the Ministry of Construction, Road and Municipal Machine Building to produce a pilot batch with the subsequent organization of mass production.

In some cases the Collegium of the USSR State Planning Committee had to "use power" and include developments in the state plans, in spite of the resistance of the ministry. Thus, the Institute of Nuclear Physics for 12 years now has been producing commercial accelerators. But the Ministry of the Electrical Equipment Industry, while using them in its own production lines, at the same time has not taken upon itself the mass production of these machines, because its enterprises' own needs are limited and the ministry should set up the production of new equipment "for others." But since commercial accelerators open the way to the use of radiation technology in the most different sectors of the national economy and can yield an economic impact of many millions of rubles, the USSR State Planning Committee correctly considered their mass production a nationally important matter. It was decided that to start with the Novosibirsk Sibelektroterm Plant will begin to assimilate the production of accelerators in cooperation with the Institute of Nuclear Physics, and then gradually will fully take upon itself the series production of these machines.

"We are convinced," Chairman of the Siberian Department and Vice President of the USSR Academy of Sciences Academician V. A. Koptyug says, "that the state

levers of control can work quite effectively in the determination of the fate of new developments, it is necessary to use them as extensively as possible. Indeed, as previous experience shows us, the inclusion of a development in the plan of sectorial introduction still does not mean that it will be fulfilled. It is necessary to increase the responsibility of ministries and departments for the fulfillment of the plans on new equipment, as is envisaged by the decree of the CPSU Central Committee and the USSR Council of Ministers 'On Measures on the Acceleration of Scientific and Technical Progress in the National Economy.' For the present, unfortunately, the demands on the fulfillment of the plans on new equipment are much easier than those on production assignments. And, of course, it is necessary to include the economic levers of management for the acceleration of the introduction of new equipment in the national economy. The matter will not be resolved by orders alone, it is necessary to create an economic interest so that the ministries themselves would pursue new efficient developments, while it is not scientists who would 'impose' them.

"We have drawn for ourselves conclusions about those works which were not adopted for extensive introduction. And during the new five-year plan, having received the support of the USSR State Committee for Science and Technology and the USSR State Planning Committee, we will strengthen in every possible way the design and pilot production base of academic institutions, in necessary cases organize the production of small series of advanced innovations and offer them for experimental use. This will substantially facilitate their advance into industry."

From the work on the suggestions of the Siberian Department of the USSR Academy of Sciences on the introduction of innovations during the next five-year plan all its participants learned lessons. In accordance with this principle the USSR State Planning Committee is now organizing work on the suggestions of other large detachments of Soviet scientists. And this, of course, will benefit the country.

They say that time is money. This formula in our age of scientific and technical progress is acquiring a special meaning. It has been calculated that the speeding up of the time of introduction by 1 year will provide the country a saving of 5-6 billion rubles. This is a fifth of all the annual allocations for science. The game, as they say, is worth a candle. Especially as it is possible to obtain the lion's share of these 5-6 billion rubles only by the more efficient control of the conveyor of introduction. And it is necessary to spare not pains to speed up its movement.

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CSO: 1814/79

TRAINING

USE OF GAMES IN DEVELOPING DECISION-MAKING ABILITIES

Moscow IZVESTIYA in Russian 20, 21, 22 Nov 84

[Article by IZVESTIYA special correspondents Ye. Manucharova and M. Khromchenko: "A Game Like Life"]

[20 Nov 84 p 3]

> [Text] Do not be distracted. Not by current affairs, not by family concerns, not by telephone calls. There was no telephone in this house. But there were the prorector for science, 16 professors, 20 docents from 1 institute plus specialists invited from outside. And us--two journalists. For 7 days--from 10 o'clock in the morning to 10 o'clock in the evening--we were all busy with the search for answers to the most important questions.

Chapter One

Everything Begins With the Future

"Do you want to participate in a game? We warn you: it is a 7-day effort."

We plunged into the game.

Passions raged. Scientists seem calmly estranged from life only to people who are totally unacquainted with the world of science. It is an illusion. Without excitement, emotions there is no genuine science, without the ability to defend one's position it is impossible to conduct research. So it was here as well.

Diametrically opposed opinions poured down. Words, which in a different place could have been taken as a personal insult, were heard. Accusations of amorality (of those who defended the right to "pure" science: "do you want comfort zones?", "do you want to satisfy your own curiosity at the expense of the state?"). Counter accusations of lack of professionalism (of those who in the solution of any scientific problems directed their attention to the demands of practice: "do you intend to patch holes all your life?"). Posters, which showed that the players (the professors and docents of

MINKhiGP--the Moscow Institute of the Petrochemical and Gas Industry imeni I. M. Gubkin) know fiction well, hung on the wall. They knocked each other with the aphorisms of B. Shaw: "A narrow specialist learns more and more about less and less, and so it is until he knows everything about nothing and nothing about everything." But then they bowed and scraped politely, in the jargon of young people: "We did not want to make an insect of you."

By what does any game attract? Is it all the same whether it attracts a child or an adult? By the opportunity to estrange oneself for a while from everyday life--by competitive uninhibitedness. It makes it possible under the conditions of unpredictable situations to test one's strength and to increase it. Each one teaches.

What did this one teach? The ability to make decisions. This is the basis for the driving of a motor vehicle, the management of one's own life and production. Any decision intrudes upon the future. The accuracy of decisions depends on the extent to which it is possible to foresee it. Hence, an analysis and forecast always precede a decision. But what if time is short, the situation is unclear and the fate of an important matter depends on the decision? Here it is difficult to decide and to make up one's mind. How is this to be learned? People have always helped themselves with a game. When it comes to games, mankind displays the utmost inventiveness.

Chess from the earliest times trained the ability of military leaders to see several moves ahead, to foresee the actions of the enemy. "Business games" (or "games in executive decisions") have become a tool of the training of modern managers in all developed countries. The different games have different tasks and possibilities. Some develop professional abilities, as scales do for a pianist. Others help to clarify the situation, to see the deadlocks. If you do not want to fall into them and want to choose the optimum means of development, order a game. Specialists in game playing and methodologists are one of the highest paid occupations in the world.

In recent years the tasks, which require the efforts of many collectives which consist of a large number of various specialists, have been increasing. The solution of such state, sectorial and intersectorial programs requires concerted actions, flexible coordination.

The simplest model of coordination, which everyone knows, is once again the game. Take the soccer team. Its victory depends on the behavior of each of the 11 soccer players. The situation on the field changes very rapidly. It is necessary to assess it instantaneously, to submit one's own opinion, to make a decision and to carry it out. Each person in his own way, without any order whatsoever from outside heads toward the achievement of the common goal. The actions of everyone are concerted.

The latest types of games were formulated for the development of the mechanisms of the coordination of collective actions when solving national economic problems. Ours was called ODI--the organizational activity game. The latter requires interpretation.

In one of the organizational activity games the managers and leading specialists of one plant were asked to indicate the bottlenecks in the work of the entire enterprise and of the executives who have to correct the situation. The responses were shown on a poster. They singled out in red the assignments which are planned by each person for himself. In blue--for others. The result turned out to be amazing: the entire table radiated in blue. Each player assigned to himself only 6-7 percent of the forthcoming work and shifted the rest onto others.

In life it also happens that way, does it not? The lagging enterprise, as a rule, shifts: the blame onto suppliers, the responsibility onto related enterprises, reorganization onto the authorities ("let them think!"). The rules of our game dictated an opposite approach. The participants in the game can contemplate and suggest only what they themselves will also implement. There are no other performers, it is necessary to count only on oneself.

The associates of the Moscow Institute of the Petrochemical and Gas Industry imeni I. M. Gubkin had to make a decision, rather, a string of sequential decisions, of which the comprehensive goal program of scientific research work consists. At first the goals (a branching "tree of goals") should have been determined, the proposed restrictions and means of influence on the object, for the sake of which the program was developed--the Caspian Sea region--should have been established. The development of its resources in the next few decades will have a substantial influence on the fuel and energy potential of the country.

It would seem that there is also a region, which is traditional for the institute, for tens of scientific, planning and production collectives. And comprehensive programs have been formulated. Why, then, was such a game required for this one?

Because at the institute they were convinced: it helps to overcome individualism, "farmstead" thinking, the aspiration of chairs to confine themselves to their own scientific theme. It is impossible to solve the new problems, which are arising in Central Asia, Eastern Siberia and now in the Caspian Sea area, while remaining in the position "my chair is my castle."

It is necessary to expedite the combination of small collectives into a large one, to make this process more stable and not to allow it to become damping. So said Rector and Hero of Socialist Labor Professor V. N. Vinogradov to us.

Representatives of many specialties: geologists and geophysicists, chemists and hydrodynamics experts, mathematicians and economists, drillers and lithologists, took part in the game. Professionals of the highest standard (about many they say that he belongs to the "three," the "five" leading ones in the country, in the world). Up to now they were accustomed to thinking in a traditional framework, by the methods and in the language of their occupation. Now they needed a common result, a joint opinion on a subject, the joint choice of approaches for the accomplishment of the joint program. The type of game, which was ordered, was precisely designed for the development of contacts.

It began with self-determination--the choice of positions. The participants were broken into expert groups--teams, on whose morning coats there was traced: scientific support, automation, consequences, ecology, problems of introduction. There were 12 of them.

The wealth of the deep stores of the Caspian Sea region is still a secret. "Fluids"--a mixture of petroleum, gas and condensate--are stored in a unique natural autoclave. There both the temperature and the pressure are extremely high. The untouched fluids are calm, but what will happen to them when a drill pierces the cap of the autoclave? How is one to control the hydrogen sulfide and carbon dioxide--gases which are useless and even harmful for the environment, if they are discharged into it, but at the same time valuable raw materials, if they are processed?

The problem of recovering samples worried the physicists, who were obliged to answer the question, how do fluids behave in critical zones, if the balance of pressures is disturbed--a 7-km section is drilled through. Basic research is needed.

"It is extremely important," an expert driller agreed, "and we are ready to help you in every possible way, but it is still unknown how in practice to get through the section. The drilling bits and the pipe do not withstand a corrosive medium."

On one of the most frantic days two posters were hung above the microphone, to which the disputants came out. On top is "The Caspian Sea region of the 21th century not only is more unusual than we imagine, it is more unusual than we can imagine." This was a statement of a deadlock (each problem was joined with others, which are not solvable without the remaining ones). The poster called upon one to think further, to look at the problem from an unusual angle. It was necessary to change one's "skin," not having parted with which the professional--as the poster below stated--"in search of a solution to the problem successfully avoids minor errors, while steadily aspiring to some global misconception."

And none of them, the specialists of the highest standard, was to blame. Just as the characters of the well-known fable, who did professionally and efficiently what they had been trained to do since childhood: to long for the clouds, to move backward and to stretch in the water, were not to blame. The Swan, the Crayfish and the Pike were not able in principle to united efforts, and therefore the cart with a load of 150 years remains in the former place.

"A deadlock?" we asked the methodologists.

"Of course. Without having recognized its inevitability, no one would move farther. It is better to bury oneself 100 times in a deadlock in a game--a model of life, that even once to make a mistake in real life"

The third day ended. A sleepless night began to fall.

[21 Nov 84 p 3]

[Text] Chapter Two

Experts and Responsibility

The person who invented zero was a genius. Having shown that nothing is nothing, he gave a reference point. When choosing a decision zero is still also an alternative. For to do nothing is also a decision, the consequences of which also go into the future.

After 3 days of stresses many players chose evasion of a decision. But there were more persistent people, with a more developed sense of responsibility. Having thoroughly tormented themselves during the night, they formulated their own recommendations.

The main idea of their decisions is emulation of a leader. The authorities choose the goal. The others align themselves to the united policy of a single leader. Thus the "vector-director" appeared. An ascending short flight of stairs along a hierarchical staircase was proposed: all the laboratories and departments subordinate their interests to the tasks of the institute, the institute--to the sectors and so on. In short, the vectors of everyone are lined up "into a front" in conformity with the direction which the client gives.

The hall began to get noisy. They accused the author of "veiled libertarianism." The opponents recalled that, according to present-day notions, it is possible to draw between two points not one, but several lines which indicate the shortest distance. So it is in non-Euclidian geometry.

So it is in economics as well: in case of the choice of trajectories of the development of the national economy the number of possible versions is now increasing. Scientific and technical progress is making it possible to replace some resources with others, to choose different means of meeting the needs of society. Which is better? The most experienced and well-informed director will not decide this personally. Collective wisdom is needed.

The Moscow Institute of the Petrochemical and Gas Industry imeni I. M. Gubkin is 90 instructors, 1,200 scientific associates, this is chairs and laboratories, where 130 doctors of sciences and 750 candidates of sciences, 600 special students and graduate students work. This collective has achieved great, important gains. The science of higher educational institutions is a mighty force. But times are changing, and people, having looked around, are suddenly noticing that they are being squandered on unpromising themes, on uncoordinated studies, which are not interconnected by common ideas and goals.

The touchstone for any collective is the readiness for reorganization. It is possible to understand that you are working in the old way, but not to have either the strength or the desire to set out on unbeaten paths. Both courage and the confidence that the collective is capable of movement in a new direction, are required in order to turn the rudder. We had thought about this already at the editorial office, while reading the words of Comrade K. U.

Chernenko, which were spoken by him at the meeting of the Politburo of the CPSU Central Committee: "...it is necessary to take into account that those, who today are not striving for the improvement of their work, tomorrow may reinforce the ranks of the laggards."

The first version of the scientific research work, which the intersectorial science of higher educational institutions on the Caspian Sea region is taking and should take upon itself, was formulated at the institute at the beginning of the year. It was also decided to modify the program on the basis of the game, which was organized on the principles of systems analysis.

A tense fourth day took place. Prorector for Science and Chief of the Chair of Systems Geological Research of the Lithosphere A. N. Dmitriyevskiy moved from hall to hall, from room to room, daily scrutinizing the work of two or three groups. We detained him:

"Anatoliy Nikolayevich, how do you evaluate the immediate deadlock which the game has entered?"

"With well-founded optimism. Not the game, but our traditional thinking has entered a deadlock. We are playing precisely in order to discredit it. Without this you will not develop new principles of the formulation of a comprehensive program and will not break away from the first version."

Why was it not suitable? For the lack of coordination. The chairs and laboratories of the institute chose in the Caspian Sea region types of tasks, which are familiar for themselves, and planned to work as before on their own at the pace to which they had become accustomed. The success of one group in this case did not influence in any way the progress of the others and did not speed it up. The common cause was broken up into the sum of autonomous studies which were not interconnected. But prior to the game this did not worry the chairs.

Now they were stumbling upon gaps and were losing their temper. It seemed that here they were not to blame. There are simply not the necessary directions. Both at the institute and in the game. Let the appropriate specialists come, then the program will be formulated.

"I can say how to do it. I know this. But I do not know with whom to do it."

Here is the formula which one of the players, who refuted the idea of a "vector-director," advanced.

"Set to work!" they said to him. "We will find you people."

"Not for the world!"

This was the second deadlock, before which the game placed the professional "specialists." The deadlock of the uncontrollability of the expert: by his advice and consultations he specifies decisions, but does not bear responsibility for their consequences. In the science of control there exists

as an axiom the thesis: only whoever also take responsibility for the end result, has the right to power, that is, to a decision.

On the fifth day of the game we suddenly heard words which showed that this principle was understood:

"If I do not depend on anyone and no one depends on me, if I can present the results of my research after a year, after 2 years, after 3 years and this does no change anything, it cannot be a question of any comprehensive program! This is simply the sum of thematic plans which are not oriented toward the chosen common goal."

So said one of those who at first had completely rejected the game method. The opponent of the "vector-director" agreed with him.

"The essence of the matter is that there is no responsibility for the result. We heap it on the 'superior uncle,' while we ourselves deal with any theme which is connected with the main goal either indirectly or in no way at all. I believe that we are only now beginning to move into the Caspian Sea region. Now, when they have understood that without personal responsibility for the common cause it will simply not exist. Only I can do what I can. There is no one who could do this for me."

The flywheel of dissatisfaction with oneself gathered momentum with difficulty. Punctually, day after day, the methodologists recorded all the deadlocks and conflicts, all the victories and steps toward a unified collective, toward which the professional "specialists" were moving. And daily the "hour of reflection" came. In its mercilessly unbiased "mirror" the players saw themselves from the side. A quite unpleasant ordeal.

In front of everyone to admit to yourself that you do not know something, do not understand something, do not know how to do something! Far from everyone is capable of this. And the powerful systems of self-defense of the brain come into action. At first you accuse anyone you like, but not yourself. Only later do you make demands on yourself. Already greater ones.

In collective thinking there is also genuine protection--the adding up of forces, the interest of contact. That is why the experienced production manager organizes a conference, a planning meeting so as to organize joint thinking, a two-way discussion. Information arrives from all directions. The responsibility (and it increases the intensity of thinking) rests on the real performers.

But at an ordinary conference, even a brilliantly thought out one, equality is rarely achieved. No matter how you turn, there are chiefs and there are subordinates. In the game everyone is equal. Each is free to express any thought and to defend it. The competition of ideas makes it possible to choose the best one--the one that gets everyone out of the deadlock.

"The 'anti-deadlock' competition of ideas suits us very much. So as to use more efficiently the scientific potential of the institute. In the training of students. In the faculty for the improvement of the skills of

specialists," Professor K. S. Basniyev said. "It is a matter not of one, though even very important program, but of the fact that we are firmly changing over to advanced methods of planning. And we are learning."

On the sixth day the feeling that the gaps between the studies of specialists of different types put up restrictions, had disappeared among the players. It became clear: "holes" in case of the preparation of a program are inevitable and fruitful. Not having stumbled upon unsolved problems, it is impossible to move ahead. The boundaries between traditional scientific subjects in the 20th century have become not without reason the points of the development of new sciences.

But is it possible to plan discoveries? The 19th century replied unequivocally--no. The practical experience of the 20th century gives just as unequivocal answers. But diametrically opposed ones.

The development of atomic energy, the going into space and the development of computer technology from the very start required goal programs. They should have been completed in the specified time. It is well known that they were fulfilled. In our newspaper Academician B. Ye. Paton, whose article they quoted at the game, wrote about the need for such goal-oriented basis research for the solution of the most important national economic problems. Their goal-orientation predetermined introduction itself: the results of scientific developments no longer "are being squeezed in," but are being assimilated by those who need them.

The understanding of the fact that basic research from the start should be accompanied by introduction, became another of the results of the game. A very important one, but not the last.

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[Text] Chapter Three

In Order Not to Remain Overboard...

How joyfully the last day at the game differs from the first days! Instead of skepticism and mutual recriminations there is a willingness to support and develop an idea which has been advanced by others. The process engineers want to coordinate their proposals with the ecologists, the automation group is listening to the consequences group. A principle, in accordance with which the tree of goals for scientific research will grow, has been developed. The lower branches are the specific problems which the scientists of the institute can already solve. The branches higher up are the long-range problems, within which the "clusters" of new tasks--for tomorrow and the day after tomorrow--are ripening. A specialist, who will actually be responsible for the use of his own methods in the Caspian Sea region, will set to work on each of them.

Three problems are pressing in the era of scientific and technical progress. Three problems, without which there would be no talk of scientific and

technical progress. They are well known. There is basic scientific research. The introduction of its results in practice. The training of personnel who are capable of solving both the former and the latter.

Under these conditions the human factor assumes the greatest importance. People are different. And this is good. The richer the collective is in the spectrum of units which make it up, the greater the deeds it is capable of. But how is one to teach each person to turn to the collective his best qualities and to participate with interest in the common cause?

It is good to have a good teacher. To work under the supervision of a person, whose audacious thinking is ready for contact with a surprise, with new facts and phenomena, which come into conflict with generally accepted views. Precisely such contact determines the end result--the quality of thinking of students. Nikolay Kibal'chich, German Lopatin, Aleksandr Ul'yanov, remarkable people, social revolutionaries, came from the school of the great revolutionary in science D. I. Mendeleyev. And this is natural. He asserted: a teacher should be not a "performer," but a "exciter." He should not hammer into the heads of his students old copybook truisms, but should awaken the creative element, the capacity for understanding the new and the independence of thinking.

What, how and where is one to teach today the student-specialists, who have to work in the 21st century? The questions are different. Answers should be found to all.

"Where?" Not only on the problems being solved, but also on unsolved problems.

The answer to the question "What?" lies near by. Not only specific specialized knowledge, but also the ability to use it.

And "How?"! Not only to convey "packages of knowledge," but also to introduce active methods of instruction. One of them is the game.

They began to introduce it especially vigorously since the time when psychologists showed that for leader personalities contacts with other people (interpersonal relations) are interesting only when they are colored with the excitement of a struggle for victory, with the unpredictability of the result and with rivalry. In short, precisely with what the game gives. With the appearance of electronic engineering the computer was also subordinated to this task.

Children, who are intrinsically entering the world of future technology, readily master it. It is also useful for the retraining of a manager, of an adult, who was deprived in childhood of the opportunity to become familiar with electronics. The computer is tactful, adjusts itself to the speed of the thought processes of the specific learner and does not submit his mistakes for public discussion, thereby speeding up the process of mastering the material and making it possible to catch up with those who have moved ahead.

The youthfulness of the mind is determined not by passport data, but by the ability (physiologists claim) to learn, to reform, to turn to the new. This is difficult, but necessary. Such are the style and requirements of the age. Innovations are more and more often intruding into life. If you are not able to reform in time, you will remain overboard.

A network of institutes for the increase of the skills (IPK's) of production organizers, at which the computerization of instruction has been introduced, has been set up in the country. We visited the Chair of Applied Mathematics and Computer Technology of the Institute for the Increase of the Skills of Management Personnel and Specialists of the Ministry of the Automotive Industry (the director is Docent V. V. Fomin).

Each of the students interacts with one of the computer displays. The computer gives a series of small problems. If you do not answer, it means you have worked poorly with its program the preceding 4 hours, when you were becoming familiar with the material. The computer is an examiner? It is a matter not only of this. The students compete with each other in the speed of responses. The relations with the collective and the desire to be more intelligent than the computer are also game stimuli which are quite effective.

There is also another system of relations of several participants with the computer. For example, the simulation of various deadlock situations with the study on computer of the versions of a way out of them.

We do not presume to evaluate all the experience of games in the country. But is seems to us that this method of instruction is being developed more slowly than is necessary and possible.

Probably, one of the reasons is objective. Games are not perceived by people as something respectable and serious. Such an attitude was established in us from the earliest times. In the papyruses of Ancient Egypt it is mentioned that they sent the people, who were convicted of games of change, to work in the quarries. The recklessness of the player was also considered a shameful defect in the past century. They concealed it. Chess boards and boards for nardy [type of game] were produced in the form of books. Serious inscriptions were printed on their spines. For example, "Domashniye vechera: tom 1 i tom 2" [Home Parties: Volume 1 and Volume 2]. They used them in order not to show their passion for what was considered entertainment, but in reality was gymnastics of the mind.

And now it seems a bit strange to many people that they are being torn away from current affairs, from the drive for the plan in order to be thrown into retraining, and besides by the game method. But this is only one of the obstacles in the way of games. Among them there is also another, very significant one: special programs and the active development of information science are necessary for a game with a computer. The formulation of such programs is an extremely complicated and labor-consuming job. An understanding of human psychology is required.

We saw what labor lies in the thought out organization of a game at the game, which was held by the institute for the sake of the Caspian Sea region. After

they let the players go rest at 10 o'clock in the evening, after a 10-hour workday the methodologists headed by the director, Candidate of Philosophical Sciences G. P. Shchedrovitskiy, a long-established author of our newspaper, gathered at their conference. They went over the disruptions and conflicts of the players, the possibility of intensifying the game, of accelerating or slowing its pace. They relied on the knowledge of psychology, logic and the methods of systems analysis. Many had behind them tens of large and small games, which were held at industrial enterprises, scientific research institutes and higher educational institutions. The opinion of the clients is unanimous: the game is conducive to the increase of the efficiency of collective work. It is not by chance that orders, which envisage the improvement of the matter at the works, were issued more than once following the game.

One of them--that of V. P. Gruzinov, director of the State Planning, Design and Scientific Research Institute of Maritime Transport--is very characteristic. In it, in particular, it is stated that the seminar-game "revealed great untapped reserves of the increase of the level of scientific and planning work," "made it possible to formulate a number of specific recommendations on the improvement of everyday activity." Then follows the decision: "...to set up a laboratory of the methodology of the organization and development of scientific research and development with direct subordination to the director; ...to enlist in the formulation of a comprehensive goal program of the development of the institute creative groups which are made up of leading specialists, having permitted them to use for the accomplishment of this task 30 percent of their working time...."

At the next game the methodologists rarely remember the preceding games. There is little similarity in them, and the situations at each one change daily.

Because a game is a game. It is as diverse as the life for which it prepares. Only more dynamic. It makes it possible in several days to live through future experience and infects by the rhythm of movement. Professor E. A. Bakirov, who was convinced that a loss of speed leads to a loss of course, directed attention to this peculiarity of it:

"We will continue what was turned out in the game."

The last posters disappear from the wall. The expert groups complete their reports. They outlined the basic provisions of the program of the participation of scientists of the Institute imeni I. M. Gubkin in the solution of the problems of the Caspian Sea region.

The 7 days of increasing strain. Of continuous thinking in one direction. Days. And nights when an idea hounded sleep. But there is a result.

It is ridiculous to fear fatigue of the brain. Physiologists showed long ago: its reserves are so great that a person in the most difficult job does not use them. Everyone, who has gone into an intense mode of thinking, will understand Shaw. The well-known geologist and Lenin Prize winner Professor M. M. Ivanova utters his next aphorism:

"The ability to think is one of the passions, and it can give longer pleasure than any other...."

The pleasure is greater, the more difficult the path to the heights is. Everything here is as in mountaineering. The heights, to which man's consciousness should climb, are becoming more and more steep and unusual. It is necessary to train "mountaineers" of thinking. Who are capable of understanding the most complicated situations. Of understanding, deciding and make up their mind. Of assuming responsibility.

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GENERAL

DEVELOPMENT OF ACADEMIC RESEARCH, INTRODUCTION OF RESULTS

Minsk NARODNOYE KHOZYAYSTVO BELORUSSII in Russian No 12, Dec 84 pp 4-7

[Article by Candidate of Economic Sciences V. Kudashov, chief of a department of the Physical Technical Institute of the Belorussian SSR Academy of Sciences: "Together Toward the Common Goal"]

[Text] Of entire spectrum of factors of the increase of labor productivity the leading role by right belongs to scientific and technical achievements. Their use makes fundamental changes in production technology, promotes the appearance of new types of equipment and is responsible for progressive changes in the organization and conditions of labor, which lead to the increase of the output of products per unit of time. The introduction of energy-saving and materials-saving, as well as waste-free technology, the mechanization and automation of difficult and labor-consuming operations is of great importance.

Let us take, for example, a part which, at first glance, is simple--a multidiameter shaft. The traditional technology of obtaining it--by the turning of the billet on a lathe--is quite labor-consuming, the utilization factor of the metal does not exceed 0.4-0.6. The set of equipment for the cross-tapered rolling of such parts, which was developed by scientists of the Physical Technical Institute of the Belorussian SSR Academy of Sciences, makes it possible to increase labor productivity by 10-fold, the utilization factor of the metal increases to 0.8-0.98, the complete automation of the process is ensured. The sets are promising for extensive use in various sectors of the national economy.

It is possible to cite many such examples.

During the current five-year plan significant gains have been made in the introduction of scientific and technical achievements: the number of developments and inventions, which have received extensive use in the national economy, has increased, the economic impact per development has increased substantially, the first steps have been taken in the organization of the

series production of new equipment on the basis of the developments of academic institutes. The establishment at institutes of design and technological bureaus with a pilot works, scientific and technical complexes and educational scientific production associations, the orientation of scientific research toward the solution of specific production problems and the development of the goal program method of management to a large extent contributed to this.

Thus, for example, annually the Physical Technical Institute of the Belorussian SSR Academy of Sciences introduces 50-60 of its developments, moreover, 10-12 over again. In 3.5 years of the five-year plan an economic impact in the amount of 36 million rubles, including 6 million rubles at republic enterprises, was obtained. Seven license agreements and contracts with foreign firms were signed. Technical specifications for series production were prepared for cross-tapered rolling complexes, presses for percussion sheet-metal stamping and equipment for electroerosion machining.

And still the yield from the available scientific and technical potential can be more significant. The question of the need for the intensification of scientific research, its orientation toward the increase of labor productivity and the more active participation of scientists in the introduction of their recommendations and inventions in production is quite correctly posed. However, it is impossible not to direct attention to the fact that the process of introduction still remains very complicated and excessively lengthy.

The basic causes, as has already been repeatedly noted, lie in the lack of conformity of the existing organizational and economic mechanism to the stage of intensive scientific and technical development.

The demands to direct attention to a high level of research frequently are not backed by a system of evaluation and stimulation subject to the progressiveness of scientific and technical solutions. In case of the choice of themes and the planning of development the achieved world level with respect to some scientific directions or objects of technology or others is not always taken into account. The changeover to the development of new directions of science and technology is being accomplished slowly, many collectives prefer to elaborate old themes which have reached their limit. Enterprises more willingly undertake the introduction of simple innovations, which does not require great expenditures and organizational efforts. Their use makes it possible to solve only narrow production problems, without radical changes of the technology. The models of machines and equipment, which are being developed, are inadequately aimed at the needs of a specific works and in a number of cases are not incorporated in production lines. As before the problem of overcoming departmental barriers when assimilating intersectorial developments exists. A large portion of the research of academic institutes and higher educational institutions of the republic is being introduced in unit amounts, to get into series production it is necessary to pass through a large number of stages of coordination and to overcome the numerous obstacles which are being raised on the part of the head sectorial organizations. Although, at first glance, precisely they should assume the basic troubles on bringing scientific developments up to mass use in the national economy.

What is it necessary to do for the more efficient assimilation of scientific and technical achievements? First of all, it is necessary to increase the interest of all the units, which are involved in the creation, development and extensive introduction of new equipment. It would seem that production is objectively interested in the use of the recommendations and inventions of scientists, since they, as a rule, significantly increase labor productivity and yield the enterprise a real profit. And still for the present precisely scientists are displaying greater activity in the introduction of the results of research. This is occurring primarily because the further development of the material and technical base of science, the increase of the amounts of financing and the increase of the number of scientific and technical personnel can be accomplished mainly by means of economic contractual operations. But in order to find a client, it is necessary to guarantee him the solution of a given production problem with a specific efficiency.

Production is also interested in using the results of scientific research, if they have been materialized, their suitability for specific conditions, efficiency and economic expediency have been confirmed. But only organizations, which have a large design and pilot experimental base, can offer results of research, which have been embodied in prototypes. The majority of proposals of scientists appear in the form of scientific reports, methods, calculations, recommendations and descriptions of inventions. In order to use these results, it is necessary to cover the long path of development, checking and assimilation, which is accompanied by great expenditures and involves a certain degree of risk. This especially concerns fundamental innovations. Moreover, the introduction of new equipment, the recommendations of scientists and inventions as yet has not become in practice one of the basic indicators, in accordance with which the activity of enterprises is evaluated. As a whole at the machine building enterprises of the republic the proportion of the bonuses for new equipment does not exceed 3 percent.

The following important question has also not been settled: What is to be grouped with new equipment? In practice the measures on the improvement of operating equipment, which repeat the decisions of yesterday, but at times have no bearing at all on technology, take up the largest proportion in the plans. Mainly measures, which have been proposed by one's own workers or have been recommended by sectorial institutes, are included in the plans. The developments of academic scientific organizations and higher educational institutions remain in the background, although, in the end, precisely they can revolutionize production and yield the greatest impact. Thus, whereas the impact of the introduction of measures of scientific and technical progress as a whole in republic industry in 1982 came to 189 million rubles, the impact, which was obtained just from the introduction of developments of the Belorussian Academy of Sciences in the national economy of the country, came to 147 million rubles. The effectiveness of the expenditures on measures of scientific and technical progress for industry comes of 0.54 ruble/ruble, the effectiveness of the introduction of developments of the Belorussian SSR Academy of Sciences with respect to all expenditures on scientific research work is 3.1 rubles/ruble a year.

Consequently, industrial enterprises when formulating the plans of new equipment should direct attention to the most efficient developments of academic scientific organizations and higher educational institutions. First, the introduction by way of legislation of precise criteria of the grouping of developments with new equipment would promote this. Second, an individualized approach to the level of equipment and its national economic need should be reflected in the system of planning, pricing and material stimulation. The decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy" aims us at this. In particular, it is permitted to pay bonuses in excess of the established maximum amounts for the development and introduction of new equipment, advanced technologies and materials, which conform to the present technical and economic level or exceed it, as well as for the increase of the proportion of new highly efficient products in the total production volume. Third, the organizational mechanism of the transfer of scientific achievements to production requires substantial improvement.

The contract is the basic form of such a transfer. The economic contracts, which are concluded directly by organizations and enterprises, have become most widespread. At the Belorussian SSR Academy of Sciences enterprises account for more than 60 percent of the economic contractual operations, which provide nearly 80 percent of the derived impact. The analysis of the performed research shows that the bulk of it is aimed at the development and introduction of new instruments, equipment, computer hardware and technological processes. But, as a rule, only single and at best small batches of experimental models, which are used on a limited scale, are produced. The further dissemination of these developments repeats the covered path as applied to the conditions of another works. However, scientific organizations objectively cannot engage in this work, but without their participation the process of introduction becomes complicated. The system of contracts on creative cooperation, which presume the joint solution of problems, also needs improvement.

In recent years, owing to the design and pilot experimental base which has been created at a number of scientific institutions, the copying of individual developments in accordance with contracts for the transfer of scientific achievements has been carried out. At the institutes of the Belorussian SSR Academy of Sciences the proportion of these contracts comes to approximately 10 percent of the total amount of contractual operations. It seems that this form will undergo further dissemination. However, it is necessary to use it within reasonable limits, for the main task of science is the performance of basic research.

The above-named forms have been adequately tested and in practice provide the entire impact from scientific developments. However, this is insufficient for the transition to a qualitatively new stage of the increase of labor productivity.

It is necessary to develop more actively the multilateral contractual relations of scientific institutions, sectorial organizations and enterprises. At present academic institutes perform jointly with sectorial organizations only 11 percent of the contractual operations. This, undoubtedly, is too

little. In our opinion, the development of extensive cooperation, on the one hand, between scientific institutions and, on the other, between scientific institutions, sectorial organizations and enterprises is necessary. This cooperation is of especially great importance for the development and extensive introduction of automated complexes of equipment and closed technological systems. It is impossible to imagine modern technology without the extensive use of electronics, automated control systems, machining centers, robots and manipulators. Since every organization specializes in a relatively narrow area of research, the cooperation of scientific organizations and the integration of their efforts and resources are a necessary condition of the successful accomplishment of comprehensive development. The participation of organizations and enterprises of various sectors, which can, for example, assimilate the production of new materials and single-design equipment, organize the production of components and provide the necessary services, is required for the large-scale introduction of scientific and technical achievements, especially of an intersectorial nature. Positive examples of such cooperation now already exist in practice. Thus, 4 institutes of the Belorussian SSR Academy of Sciences, 8 higher educational institutions, 3 sectorial planning and design organizations and 27 associations and enterprises are participating in the development and industrial assimilation of a strain-hardening technology. In 4 years the Center of Strain-Hardening Technology has developed more than 40 new technological processes, 19 units of equipment and 13 compositions of materials. In our republic 47 production sections, in which new technology has been introduced, have been set up, the economic impact for 4 years came to 16.5 million rubles. The Center of Strain-Hardening Technology could work even more efficiently in case of the combined solution of all the problems connected with introduction. Unfortunately, the pace of the development of means of control of technological processes and the quality of the coatings being applied, means of mechanization and automation lags significantly behind the development of the technology itself. The head organization, the Physical Technical Institute of the Belorussian SSR Academy of Sciences, which is responsible for the fulfillment of the program, does not have economic levers for the assurance of the proper coordination of the work being performed.

Goal program planning is a fundamental direction of the solution of these problems. The ultimate goal of the scientific and technical program is the substantial improvement of the technical and economic indicators of production and the level of the output being produced. The assignments of these programs, as a rule, are oriented toward the organization of the production of new equipment and the introduction of advanced technology. However, for the present such planning has not developed into a factor which unites the potential of various organizations for the achievement of one common goal, some developers are not joining each other, problems of material and technical supply and the training of personnel are arising. The further development of the goal program method also requires the assurance of organizational and procedural coordination in case of the formulation of the programs and their fulfillment and the increase of economic interest. Unified management in the person of a scientific supervisor or chief specialist of the program, who has been given certain powers in the distribution of financial, material and technical resources and bears responsibility for the success of the matter, is also necessary. As an orchestra needs a conductor, so a program requires its

own manager. It seems that powers in the formation of temporary scientific and technical and production collectives, the establishment of which is envisaged by the decree of the CPSU Central Committee and the USSR Council of Ministers, should be granted to him.

Trilateral contracts, which unite an academic institute, the head sectorial institute and an enterprise, are a promising form of the organization of the series introduction of scientific developments in production. The economic contract between the Physical Technical Institute of the Belorussian SSR Academy of Sciences, the VNIIreduktor [not further identified] (Kiev) and the Leningrad Reduktor Plant, which envisages the assimilation of the technology of the magnetic abrasive machining of parts, the production of experimental units and the designing of equipment with its subsequent introduction at enterprises of the sector, might be a good example.

Thus, trilateral agreements afford basic developments an outlet to introduction in the sectors of the national economy. However, they become possible only at a specific stage of the cooperation of the academic and the sectorial institute--after the production of an experimental model by the academic institute. And the objective prerequisites for the conclusion of the "academic institute--sectorial institute--enterprise" trilateral contract emerge only after obtaining positive test results. Further research and design work, the operational development of the experimental model, the output of the trial batch and series production are envisaged in it.

It should be noted that such a form of the integration of science with production is especially promising for academic scientific and technical complexes, which have their own pilot works. At the Belorussian SSR Academy of Sciences at present special design and technological bureaus with a pilot works have been set up at nine institutes. As a result the path from the invention to the experimental model has been shortened significantly.

Owing to the setting up of a special design and technological bureau, the Physical Technical Institute of the Belorussian SSR Academy of Sciences just during the years of the current five-year plan has developed, designed, produced and turned over to production more than 40 units of equipment for the implementation of such promising, highly productive technological processes as cross-tapered rolling, percussion sheet-metal stamping, magnetic abrasive, electroerosion, laser and plasma machining, precision stamping, the obtaining of parts from composite and powder materials and a number of others.

The further increase of the efficiency of scientific and technical complexes can be achieved by means of comprehensive planning, the consolidation of the pilot experimental base and the improvement of the material and technical supply of developments. Annually only 38-43 percent of the orders for equipment, instruments, materials and tools are filled. The economic contractual operations in accordance with the orders of enterprises are being poorly supplied with materials and components. Therefore it is necessary to change radically the formed situation, in case of which the success of a development is made dependent on the ability of suppliers to get materials and components "elsewhere."

The first steps in the development of relations between academic and sectorial organizations with a subsequent outlet into series production require considerable support both on the level of the improvement of the mechanism of management and on the level of legal backing.

At present the head institute, which determines the technical policy of the sector, is not interested in the introduction of the "others'" development. The departmental approach, which is manifested in the aspiration to retain the prestige of the "arbiter of fashion" in the sector, has the result that mainly its own ideas and inventions are introduced in production. As a rule, they are aimed at the improvement of the existing technology and objects of equipment. And only if the results of the research of the academic institute are turned over for revision and introduction without its participation, that is, in case of the transfer of all the rights of the basic originator of the new ideas and inventions to the head institute of the sector, is it possible to count on the introduction of developments on a broad scale.

By modifying the technical specifications as applied to the conditions of a specific works, the head institutes become the authors of the development. The scientific organization, whose ideas or inventions were the basis for the development of the new equipment, does not appear either in the technical specifications or on the product being produced.

Consequently, the mechanism of the transfer of the results of scientific research for assimilation and copying in the sector needs substantial improvement. First of all, it is necessary to elaborate the procedure of the transfer of the results of the basic and applied research of academic organizations and higher educational institutions to production. In it the demands on the technical level of the development should be specified, the responsibility of the sectorial organizations for objective examination and use should be increased, clear regulation of the joint participation in the fulfillment of the individual stages of the work should be given. It is also no less important to establish the proportionate sharing in the obtained economic impact and the corresponding material stimuli. This will make it possible to lend standard force to the introduction of the developments of academic organizations of higher educational institutions.

Finally, the efficiency of introduction is determined by the system of evaluation of the activity of organizations and enterprises. The now ingrained set of quantitative indicators without the distinction of the qualitative aspect is not conducive to the introduction of major, significant developments. Analyzing the reports of scientific organizations, it is possible to see how much scientific research work was performed, how many certificates of authorship were received and how many inventions or measures on new equipment were introduced. However, a closer analysis of the statistical data shows that from 1 measure on new equipment we derive an economic impact of only 5,400 rubles, the real profit is even less. The average saving per introduced invention and efficiency proposal (the statistics, unfortunately, for the present do not separate them) in the national economy of our republic comes to only 1,600 rubles. The percent of the scientific developments, which exceed in their level the best world achievements, is not great, and only 12 percent of the models of new

equipment, as was noted recently on the pages of the journal, conform to the level of the best domestic and foreign analogues.

All this attests that for the further development of scientific research and the increase of the scale of introduction it is necessary to put organizational and economic levers more boldly to use. A more demanding approach when certifying the products being produced and the comparative evaluation of scientific and technical developments with the best world achievements along with the solution of the other urgent problems, which were spoken about above, will contribute to the substantial increase of the level and efficiency of the activity of the scientific, planning and design and production units. The significant scientific and technical potential, which we have, is affording extensive opportunities for the reorganization of production on a new, advanced technical basis. This will make it possible to increase labor productivity significantly, which is the basic direction of the intensive growth of the economy.

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CSO: 1814/78

GENERAL

BETTER DETERMINATION OF ECONOMIC EFFECTIVENESS OF NEW EQUIPMENT

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 1, Jan 85 pp 80-84

[Article by Doctor of Economic Sciences Professor D. Popov, deputy director of the Institute of Economics of the Central Scientific Research Institute of Ferrous Metallurgy, and Candidate of Economic Sciences M. Tsitrin: "On the Question of the Improvement of the Methods of Determining the Economic Effectiveness of New Equipment"]

[Text] The introduction of new equipment and the development of invention and efficiency promotion to a significant extent contribute to the increase of production efficiency. At the same time these processes are often accompanied by certain difficulties.

Among the latter, in our opinion, are the vague and frequently contradictory interpretations of the Method of Determining the Economic Effectiveness of the Use in the National Economy of New Equipment, Inventions and Efficiency Proposals, which was approved in 1977 by the USSR State Planning Committee, the USSR Academy of Sciences, the State Committee for Science and Technology and the State Committee for Inventions and Discoveries.

First of all a clear interpretation of the concept "the annual economic impact" of new equipment, inventions and efficiency proposals is necessary. Its identification with the total saving of all production resources of society (living labor, materials, capital investments) fully satisfies the requirements of the decrees of the CPSU Central Committee and the USSR Council of Ministers on the improvement of the economic mechanism and "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy."

Such an approach to the economic impact as a national economic category is the only correct one. For given the present specialization and cooperation of production, which reflect the high level of the division of national labor, often the introduction of new equipment (an invention, an efficiency proposal) requires increased expenditures in some sections of production, but provides a substantial saving in others.

In the sectorial Instructions on the Determination of the Economic Effectiveness of the Use in Ferrous Metallurgy of New Equipment, Inventions

and Efficiency Proposals, which were approved in 1979 by the USSR Ministry of Ferrous Metallurgy in consultation with the State Committee for Science and Technology and the State Committee for Inventions and Discoveries, this principle was detailed in the following manner. When calculating the amount of the saving only the items and components of expenditures, which are directly affected as a result of the introduction of a proposal, are taken into account. If the introduction reduces the expenditures with respect to some items and increases them with respect to others, this should be taken into account when calculating the saving. If it influences the change of expenditures not only at the enterprise (section), but also at enterprises (sections) related with it, when calculating the impact such changes should be taken into account. This gives reason to evaluate the efficiency of measures and to determine the amounts of the bonus funds and rewards with allowance made for the current and capital outlays both in metallurgy and in the consuming sectors (machine building, construction and so on).

Meanwhile in practice they have begun to narrow unjustifiably the concept of the annual impact to one or two conversions (processes). Thus, according to one of the letters of the State Committee for Inventions and Discoveries, the economic impact is determined only from the production of a material and the products made from it, but is not taken into account from the consumption of the latter. It is stated in another letter of it that the saving for the consumer from the use of a product, which was produced by a method which is protected by a certificate of authorship for inventions, is not taken into account.

If we follow this, when determining the impact from a proposal "for a method" it is not permitted to take into account at one plant the saving which occurred, say, at a neighboring shop (owing to the use of precisely this proposal). At the same time when determining the economic impact from a proposal "for a device" (Paragraph 13 of the mentioned method) it is possible, for example, to compare the expenditures, which have been made at a machine building enterprise in Moscow, with the saving at a metallurgical plant in Novokuznetsk. Given such a statement of the question today many inventions, say, in the refractory industry, which provide a significant saving at other enterprises (for example, metallurgical), are forced to the evaluated not according to the impact, but according to the actual value.

In contrast to the State Committee for Science and Technology and the USSR Ministry of Ferrous Metallurgy the State Committee for Inventions and Discoveries has recognized as replaceable equipment only the equipment which was used prior to the introduction of the invention at the given enterprise (such an entry was included in the sectorial instructions of the USSR Ministry of Ferrous Metallurgy in 1979). This led to paradoxical situations, when the enormous economic impact for the national economy could not be confirmed for an invention which is the basis for the given object of new equipment. But inventions (be it a material, a method or a device) might not necessarily be introduced at the enterprises where there is replaceable equipment. To a significant extent they are implemented in new shops, at new plant construction projects or plant, which are undergoing fundamental renovation, that is, precisely where replaceable equipment as the basis of comparison is absent.

In this connection at the enterprises of ferrous metallurgy the sphere of use of coefficients was broadened unjustifiably even in those instances when the proposals yielded a substantial economic impact, but there was no basis for comparison.

For the purpose of increasing the interest of developers in their quickest implementation the USSR Ministry of Ferrous Metallurgy asked the State Committee for Science and Technology and the State Committee for Inventions and Discoveries to give a clear interpretation of the concept "replaceable equipment." At the stage of the formulation of plans on the assimilation of the first industrial series, the introduction of advanced technology and new methods of the organization of production and labor, as well as at the stage of the introduction and operation of new equipment the equipment which is replaceable at the given enterprise and, in its absence, the best equipment, which is being used in the national economy, should be regarded as such. Precisely such an approach is reflected in the Clarifications of the mentioned method, which were approved by the USSR State Planning Committee, the USSR Academy of Sciences, the State Committee for Science and Technology and the State Committee for Inventions and Discoveries by a decree of 24 August 1983. Apparently, it would be correct to extend this principle to equipment, which was introduced not only after 1 September 1983, but also earlier (if the calculations of effectiveness have not yet been made for it or have not been approved).

The evaluation of proposals, which are aimed at the elimination or the partial replacement of manual labor by means of mechanization and automation, requires refinement. The impact, which is formed in this case, is not recognized by some workers of the State Committee for Inventions and Discoveries, if replaceable equipment does not countervail the invention (efficiency proposal): it is proposed to determine the author's reward in such cases only in accordance with the system of coefficients. This also leads to the broadening of the use of the latter for measures, which have an unquestionable economic impact, and does not stimulate inventing and efficiency activity for the search for solutions which are aimed at the elimination or mechanization of manual labor.

It is advisable to reject the requirement to determine the annual economic impact from the use of inventions and efficiency proposals only in accordance with formula 5 of the method. Such an approach reflects the subjective notions that it is possible to calculate the impact only in accordance with formulas which correspond strictly to the formulas of inventions. Formula 5 is only a special case for formula 2,[1] but the latter is often more preferable. Therefore it is necessary to return to their use on equal terms.

Mathematically they are completely identical and given the same initial data yield without fail the identical result. For example, when determining in accordance with these formulas the annual economic impact from the use of a proposal (on the replacement of fresh ferroalloys with an alloying composition for steel and alloys) the result is the same. However, the calculation according to the latter of them for plant works is incomparably simpler, is carried out significantly more rapidly and is much more understandable.

A unified procedure of determining the annual economic impact for new equipment, which is both "methods" and "devices" (in conformity with formula 3 of the method), was established by the mentioned sectorial instructions. This procedure is correct from the point of view of both logic and economics. From the point of view of logic because there cannot be two different annual impacts: for equipment, devices, mechanisms and so forth, with the aid of and by means of which the technological process is carried out, and for the technological process proper. From the point of view of economics because the impact calculated in this manner completely conforms to the concept of the annual impact from the use of new equipment; it can be defined as both the anticipated (planned) and the actual impact, which takes into account the data of the cost information reports and the consolidated account of the outlays which reflect the actually formed expenditures and production volume (Paragraph 19 of the method). Therefore formula 3 is being used extensively for calculations of the annual economic impact at enterprises and organizations of ferrous metallurgy for not only "methods," but also "devices." Moreover, these calculations conform completely to analogous example 9 of the method.

In connection with the experience of calculating the annual economic impact from the use of devices, which has been gained at the enterprises of the sector, it is necessary to examine the legitimacy of using for these purposes formula 4 (Paragraph 13 of the method), which in the past decade has become widespread in the machine building sectors of industry. First of all let us note the terminological confusion which has arisen as a result of the use of this formula. In the mentioned method and in a number of sectors it is interpreted as the annual economic impact from the production and use of new durable means of labor, in other sectors as the economic impact from the annual volume of the production and use of new means of labor over the entire service life (but in such a case it is not assigned to the category of the annual impact). Let us leave aside the question of whether this formula actually expresses the impact (we believe that it can be used only for the determination of the limit price for equipment, devices and so on). Numerous disputes and differences are arising over the results of the calculations between enterprises (organizations) of ferrous metallurgy and machine building, electrical equipment enterprises (organizations) and so on. The former determine the annual economic impact on the basis of the annual saving (the product cost), the latter take the saving for the entire service life of the new means of labor as compared with the base means.

The formula of the calculation of the annual economic impact from the production and use of durable means of labor was converted from the formula of the limit price, which serves the goal of determining the upper bound of the wholesale price for these means of labor. Moreover, the derivation of the latter formula is based actually on the annual economic impact, yet not in case of the production, but in case of the use of durable means of production by the consumer (for example, rolling mills in ferrous metallurgy and so forth) in connection with the fact that the adjusted expenditures in case of the production of new equipment, as a rule, are higher as compared with replaceable equipment. Here the equal profitability, at least, of the use of the base and new means of labor is taken as the starting point.

Formula 4 would not cause disputes, if only the preferability of one version or another of new equipment were determined on its basis (since the "signs" of the versions when moving from one formula to another do not change). However, it is being used in the cost accounting interrelations between enterprises and organizations--the clients and the contractors; in the systems of the payment of bonuses and rewards for the introduction of new equipment, inventions and efficiency proposals; when evaluating the efficiency of scientific research organizations and inventing activity; in pricing; when establishing incentive markups.

The use of this formula for the calculation of the annual economic impact is illegitimate for the following reasons. The amount of the saving on the production cost for the consumer during the first year of the accounting period applies to a number of years of operation of the device. Thereby not the actual, but the anticipated saving during the service life is determined, which is at variance with the aims of the State Committee for Science and Technology and the State Committee for Inventions and Discoveries at the evaluation of new equipment in accordance with the actually achieved impact. Therefore an indicator, in which the actual saving (exceeding) of the adjusted expenditures of the producer of the device and the repeated anticipated saving on the operating costs of the consumer are eclectically combined, is taken as the annual economic impact.

Since the consuming enterprises (organizations) should report for 5 years on form 4-nt of state statistical reporting (the List of Inventions and Production Prototypes Used in Production During the Year Under Review) on the use of an invention and the payment of remuneration, the saving for them not over a 5-year period, in accordance with the requirements of the State Committee for Inventions and Discoveries, but over a much longer period is taken as the basis for the calculation of the latter.[2]

Thus, the amounts of the annual economic impact of inventions and new equipment are overstated, an exaggerated idea about the importance of the given measures forms and the indicators of state statistical reporting are grossly distorted.

The overstatement of the impact leads to the overstatement of the deductions for incentive funds for the introduction of new equipment and to the distortion of the amounts of the rewards for proposals. The above-indicated circumstances also lead to the distortion of the indicators of the economic efficiency of scientific research institutes, since, if the total annual economic impact from the use of devices is artificially overstated, the amount of the proportionate impact, for which the scientific research organization accounts, is, of course, also overstated.

The noted shortcomings lead to the conclusion of the expediency of studying the question of abolishing formula 4 in the calculations of the annual economic impact from the introduction of new equipment, inventions and efficiency proposals. For the determination of the latter it is necessary to leave formula 3 as the basic one. This will significantly simplify and

standardize the calculations of the annual economic impact at enterprises and scientific research organizations.

The problems touched upon by us concern, obviously, not only ferrous metallurgy. Their clear and unambiguous solution, which reflects the more and more complicated nature of the new equipment being introduced, inventions and efficiency proposals and is oriented toward obtaining the maximum ultimate national economic impact, will contribute to the acceleration of the implementation of scientific developments.

FOOTNOTES

1. See "Spravochnik izobretatelya i ratsionalizatora" [Handbook of the Inventor and Efficiency Expert], Moscow, Profizdat, 1983, p 157.

2. In the article "Once More on the Effectiveness of Capital Investments" (VOPROSY EKONOMIKI, No 3, 1983, p 65) Academician T. S. Khachaturov writes: "Formulas 4 and 5 of the 1977 Method are incompatible, since in one case the impact for 1 year of use of a new item is taken into account, while in the other the impact for several years is. The requirement of the determination of the annual economic impact from the use of new equipment subject to its service life leads to the incompatibility of the results of the economic calculation for different sectors of the national economy and can cause major mistakes. The derivation of formula 4 shows that by no means the annual economic impact, as is stated in Paragraph 13, but the economic impact of many years is calculated in accordance with it. According to the conducted checks, the use of formula 4 leads to the increase of the rated annual economic impact for construction machinery by 7- to 12 fold. It is clear that given such mistakes it is actually impossible to use this method...."

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CSO: 1814/77

GENERAL

RECOMMENDATIONS ON ACCELERATION OF SCIENTIFIC, TECHNICAL PROGRESS

Riga KOMMUNIST SOVETSKOY LATVII in Russian No 1, Jan 85 pp 63-72

[Article: "Scientific and Technical Achievements Into the National Economy!"]

[Text] The meeting of the republic party aktiv, which was held on 19 October 1984 and discussed the question "On the Tasks of the Republic Party Organization on the Further Intensification of the Economy on the Basis of the Acceleration of Scientific and Technical Progress in Light of the Decisions of the 26th Party Congress and the Subsequent CPSU Central Committee Plenums," adopted the Recommendations of Specialists of the National Economy of the Republic on the Problems of the Acceleration of Scientific and Technical Progress, which are published below.

Recommendations of Specialists of the National Economy of the Republic on the Problems of the Acceleration of Scientific and Technical Progress

In the Area of Economics and the Management of Scientific and Technical Progress in Industry and Other Sectors of the National Economy

1. Ministries, departments, the Academy of Sciences, associations, enterprises and organizations of the republic:

1.1. Guided by the decisions of the 26th party congress and the subsequent CPSU Central Committee plenums, ought to constantly improve the methods of the management of scientific and technical progress and increase its efficiency in the solution of the economic and social problems of the national economy.

1.2. Ought to take additional steps on the overall and purposeful improvement of the work in the area of scientific and technical progress and to ensure the fulfillment of the tasks, which follow from the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy" of 18 August 1983 and the decree of the Latvian CP Central Committee and the Latvian SSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy of the Latvian SSR" of 1983.

Ought to regularly examine the problems, which are posed in them, at meetings of the collegiums, academic and scientific and technical councils.

1.3. Ought to improve the elaboration of short-term, intermediate-term and long-term forecasts for the preparation of:

scientific and technical programs;

long-range and current plans of the development of science and technology;

advanced technical and economic indicators of new items and technological progress;

comprehensive plans of the renovation and retooling of sectors and individual industrial facilities.

1.4. During the period of the drawing up of the plans of economic and social development ought to specify the most important scientific and technical achievements, discoveries and inventions, use advanced domestic and foreign know-how in the decisive directions of the development of science and technology and on their basis formulate the state and sectorial plans, as well as comprehensive goal and scientific and technical programs.

Ought to ensure here the extensive discussion of future innovations at conferences of the participants in these operations, so that each of them would know clearly the tasks and goals set for him and would guarantee the rapid and efficient achievement of the end result.

1.5. During the first half of 1985 ought to formulate long-term programs for 1986-1990 and for the period to 2000, having ensured in them the priority of the operations on:

the development of advanced and the improvement of existing technological processes;

the development and the assimilation of the production of standardized technical means of control with the use of microprocessor equipment;

the introduction of local means of automation (robots, rotary automatic machines and lines, NC machine tools and so on);

the implementation of automation in combination with the modernization of units, the development of integrated systems of the control of sections, shops and works, which ensure the implementation of unmanned technologies, first of all in sections and shops with harmful working conditions;

the development and use of computer-aided design systems (SAPR's) and standard automated systems for the control of technological processes.

1.6. For the purposes of shortening the time of the formulation of these programs, as well as the block of support subprograms:

ought to study the experience of Moscow enterprises and organizations in the comprehensive introduction of means of production automation at machine building plants and elaborate measures on its use;

ought to set up temporary collectives for the performance of work on the solution of long-range scientific and technical problems of an intersectorial nature;

ought to practice more extensively the conclusion of contracts between scientific and production collectives, on their basis organize the competition of the participants in creative cooperation for the acceleration of scientific and technical progress with the use of the Statute on the Creative Cooperation of Collectives in the National Economy of the Republic, which was formulated at the Institute of Economics of the Latvian SSR Academy of Sciences.

1.7. Ought to make the evaluation of the activity of enterprises on the development of scientific and technical progress in accordance with the economic impact, which was obtained as a result of the introduction of the achievements of science, technology and advanced know-how, the conditional and actual freeing of workers, the increase of labor productivity.

Ought to carry out the payment of bonuses to the workers of the subdivisions, who are responsible for new equipment, for the fulfillment of the plan of its development and assimilation, the increase of labor productivity.

1.8. Ought to continue the establishment and development of scientific production associations, carry out the strengthening of their production bases.

1.9. Jointly with the republic committees of the trade unions during the first half of 1985 ought to formulate the conditions and organize socialist competition in the sectors of the national economy on the introduction in production of scientific and technical achievements. When summarizing the results ought to take into account the economic impact from their use.

2. The Latvian SSR State Planning Committee:

2.1. Jointly with the Latvian SSR Academy of Sciences, the Latvian SSR Ministry of Higher and Secondary Specialized Education and other interested organizations of the republic during the first quarter of 1985 ought to prepare proposals on the improvement of the organizational structure of the management of scientific and technical progress in the republic.

2.2. During the period prior to 1 July 1985 ought to supplement the program of the development of the Republic Automated Control System of Latvia with measures on the complete automation of the management of scientific and technical progress in the automated control systems of ministries and departments with the assurance of the monitoring of the influence of scientific and technical progress on the indicators of the technical and economic development of the sectors of the national economy.

2.3. During the first half of 1989 ought to develop and introduce the network portion of the Republic Network of Computer Centers.

2.4. During the first half of 1985 ought to examine the questions of the establishment in the republic of scientific production complexes for:

the development, production and introduction of microprocessor equipment;

the development and introduction of technologies of the complete processing of wood;

the development and use of biotechnologies;

the development and production of highly effective pharmaceutical preparations and means of the chemicalization of agriculture.

2.5. During the first half of 1985 ought to examine the question of the organization of the centralized servicing in the republic of means of automation.

3. Scientific research, planning and design and technological organizations of the republic:

3.1. Ought to constantly seek means of the intensification of production, develop and use new materials and designs, resource-saving technologies, ensure the rapid introduction of completed scientific developments.

3.2. Ought to develop in every possible way the creative initiative of developers and increase their occupational skill. Ought to ensure the use in research and plans of the latest achievements of science and technology, which are aimed at the increase of labor productivity and the decrease of labor expenditures, use more extensively means of the automation of designing.

3.3. Ought to expand the elaboration of scientific and technical problems jointly with organizations of foreign countries, first of all CEMA members.

4. The Riga Polytechnical Institute imeni A. Pel'she:

4.1. Ought to perform the necessary organizational and procedural work, which ensures the substantial increase of the level of training of young specialists of the machine building type in the areas which govern technical progress;

4.2. Ought to consider the possibility of the introduction in 1985 of the new general course "The Principles of Robotics and Versatile Automated Production Systems";

4.3. Ought to organize comprehensive course and graduation designing with the formulation by students of plans of versatile automated production systems for enterprises of the republic;

4.4. Ought to ensure the broad basic training of all students in the area of applied programming, as well as the specialized training of future engineers

in the area of computer-aided design systems, the use of microprocessors, minicomputers and microcomputers, robotics;

4.5 Ought to organize the specialization of individual groups of future specialists in the set of scientific and technical problems;

4.6. Ought to use in practice the establishment for urgent and long-range technical problems of base chairs at large industrial enterprises for the purpose of the increase of the occupational level of young specialists and the shortening of the time of their adaptation at the works.

5. The Intersectorial Institute for the Increase of the Skills of Specialists of the National Economy of the Latvian SSR:

5.1. During the first half of 1985 ought to organize with the enlistment of leading specialist of higher educational institutions and enterprises the advanced training of personnel in the area of robotics, microprocessor systems and computer-aided design systems;

5.2. Ought to practice more extensively in the process of training specialists of the national economy the discussion of problem issues and business games.

6. The Latvian SSR State Committee for Vocational and Technical Education during the second quarter of 1985 ought to formulate suggestions on the organization of the training of worker-adjusters and operators of means of the automation of technological processes.

7. The Latvian Scientific Research Institute of Scientific and Technical Information and Technical and Economic Research jointly with the Latvian SSR Academy of Sciences and leading specialists of the national economy during the first quarter of 1986 ought to prepare a scientific and technical collection on promising technologies, the automation of production processes and the experience in these problems, which has been gained in the republic.

In the Area of Scientific and Technical Progress in Agriculture

1. The ministries of agriculture and the fruit and vegetable industry, rayon agroindustrial associations, kolkhozes and sovkhozes of the republic:

1.1. Ought to constantly concentrate efforts on the further improvement of developments and the introduction of scientifically sound systems of the management of agriculture, taking into account the zonal peculiarity and specialization of farms and directing special attention to:

the development and introduction of intensive early-ripening strains of agricultural crops, which make it possible to utilize as much as possible the bioclimatic potential for the greatest accumulation of the organic mass of plants;

the utmost broadening of development and the introduction of measures, which ensure the further increase of soil fertility, the accumulation of humus, the efficient use of organic and mineral fertilizers;

the purposeful and systematic development and introduction of intensive industrial technologies of the cultivation of agricultural crops;

the continuation of the improvement of the structure of the planted areas of agricultural crops, the enlargement of the plantings of protein-containing, biologically nitrogen-fixing agricultural crops.

2. The Latvian SSR State Planning Committee, the ministries of agriculture and the fruit and vegetable industry, the Latvian SSR State Committee for the Supply of Production Equipment for Agriculture:

2.1. Ought to strive consistently for the introduction of an improved structure of the machine and tractor fleet with the increase of the proportion of K-701, T-150 and MTZ-142 tractors and the furnishing of agricultural machinery which satisfies the requirements of the conditions of the republic;

2.2. By the end of 1985 ought to consider the question of the production of a number of necessary agricultural machines, first of all for soil cultivation, the procurement of fodders, the care of reclamation systems;

2.3. In 1985 jointly with the Institute of Economics of the Latvian SSR Academy of Sciences and the Latvian Scientific Research Institute of Farming and Agricultural Economics ought to expedite the research on the development of the automated control system of agriculture. Ought to use computers and mathematical methods more extensively in economic research, ensure the further expansion of applied economically sound development.

Ought to recommend to complete the research work and during the 12th Five-Year Plan to change over mainly to an automated system of calculations for the determination of the production volumes and procurements of agricultural products, the distribution of basic resources by regions and farms of the republic.

3. The ministries of agriculture, the fruit and vegetable industry, land reclamation and water resources and procurement, the State Committee for the Supply of Production Equipment for Agriculture and the Latvian SSR State Committee for Construction Affairs ought to constantly carry out the systematic renovation of production facilities (grain-drying centers, storehouses, fruit and vegetable bases, workshops, farms and others). For the drawing up of planning and technical documents ought to use the forces of the planning and planning and design bureaus, which exist in the republic.

4. The Latvian SSR Ministry of Agriculture jointly with the Institute of Economics of the republic Academy of Sciences, the Latvian Agricultural Academy, the Latvian Scientific Research Institute of Farming and Agricultural Economics ought to continue the work on the further improvement of the economic interrelations and organizational structures of agriculture with other sectors of the national economy.

5. The Latvian Scientific Research Institute of Animal Husbandry and Veterinary Science, the Latvian Agricultural Academy ought to channel forces and assets into the solution of the problems of zootechnical and veterinary science, which directly contribute to technical progress, the intensive use of agricultural animals and the increase of labor productivity in animal husbandry, including into the use and the increase of the genetic potential of the productivity of livestock and poultry.

6. The Main Specialized Design Bureau for the Set of Machines for Cattle Farms:

6.1. In 1985 jointly with the Latvian State Institute for the Planning of Rural Construction, the Latvian Scientific Research Institute of Animal Husbandry and Veterinary Science and the Latvian Agricultural Academy ought to formulate for pilot introduction at livestock farms of the republic:

plans of experimental calving blocks for dairy complexes for 424 head and blocks for housing highly productive cows for 160-220 head, having envisaged here the standard and conveyor technology of the keeping of livestock;

plans of the renovation of the basic type sizes of existing small farms for the purpose of their complete mechanization.

6.2. For the making up of mechanized production lines, which are used in the republic, ought to develop and introduce:

a feeder of unground coarse fodders;

a mobile distributor of concentrated fodders based on the Kutaisi motor block;

a grinder of root crops for small farms;

carts like the UTP-300 for the distribution of fodders and bedding.

In the Area of Scientific and Technical Progress in Capital Construction

1. The Latvian SSR ministries of construction and the construction materials industry, the Latvian Administration for Construction at Kolkhozes, enterprises and organizations:

1.1. Ought to concentrate efforts on the further development of the material and technical base of construction. Jointly with the Latvian SSR State Committee for Construction Affairs and the Latvian SSR State Planning Committee ought to elaborate during the first half of 1985 and implement during 1986-1990 specific measures on the retooling and renovation of the production base.

1.2. Ought to elaborate and implement in 1987 specific measures on the organization of the production during the 12th Five-Year Plan of high-strength gypsum plaster and a wide range of items made from it for industrial construction.

1.3. Ought to elaborate and implement during the first half of 1985 measures on the complete utilization of capacities for pearlite for the organization of the production and deliveries of warmth-keeping jackets, dry plaster mixes.

1.4. Jointly with the Latvian SSR State Committee for Construction Affairs ought to carry out during the 12th Five-Year Plan the changeover to three-layer components of exterior walls with an efficient warmth-keeping jacket.

2. The Latvian SSR Ministry of the Construction Materials Industry, construction ministries and departments, planning organizations:

2.1. During designing and construction ought to use more extensively the latest achievements of science and technology, efficient materials and components, which increase the industrial nature of the construction conveyor;

2.2. Ought to expand the production of efficient reinforced concrete components, including those made of high-strength and prestressed concretes, centrifuged, large-span panel shells, complex panels with high plant readiness;

2.3. Ought to ready in 1986-1987 production for the use of superplasticizers for the increase of the quality of concretes and the decrease of the consumption of cement;

2.4. Ought to expand the use of cast-in-situ concrete, dry plaster mixes, mechanized means of their preparation and placement;

2.5. Ought to improve in 1986 the designs of joints, windows and doors for the purpose of reducing heat losses.

2.6. Ought to expand the use of metal components delivered in sets;

2.7. Ought to increase the level of mechanization of labor-intensive jobs for the purposes of excluding manual labor and turning construction into a mechanized flow process of the erection of buildings. Ought to improve the engineering preparation and organization of production.

2.8. Ought to expand during the 12th Five-Year Plan the production and use of stamped, fastening and slinging parts, which ensure a significant decrease of the materials-output ratio and labor intensiveness.

3. Construction ministries and departments, construction organizations of nonconstruction ministries ought to improve the organizational structure of management on the basis of the approved general diagrams. Ought to practice more extensively the introduction of advanced methods of construction and launch socialist competition for the acceleration of technical progress in construction.

4. The Latvian SSR State Committee for Construction Affairs ought to improve the work on the planning and coordination of scientific research work, the development and introduction of new equipment, the tightening up of the

monitoring of the fulfillment of the assignments on the acceleration of scientific and technical progress.

In the Area of Scientific and Technical Progress in Transportation

1. The Administration of the Baltic Railroad:

1.1. Ought to increase gradually the capacity of the railway lines, over which a significant increase of the traffic volumes is planned during the 12th Five-Year Plan, by:

the construction of second tracks on the limiting lines of the Riga-Valga section and a number of others;

the electrification of the Riga-Sigulda section;

the construction of an experimental section for the testing and operational development of electric trains on the Riga-Ergli section;

the fitting of sections with heavy traffic of freight and passenger trains with centralized traffic control and automatic blocking.

1.2. Ought to continue the introduction of modern means of diagnosis of the rolling stock.

1.3. For the extensive introduction of technological complexes with the use of robotics ought to ensure during the 12th Five-Year Plan the preparation and the creation of the essential prerequisites for the use of industrial robots on the line and first of all in difficult track operations and the repair of rolling stock.

1.4. Ought to increase significantly the level of the complete mechanization of loading and unloading operations during the 12th Five-Year Plan by the introduction of highly productive materials handling machines, the improvement of their maintenance and the improvement of the organization of operations.

1.5. Ought to increase significantly during the 12th Five-Year Plan the volumes of container and package shipments.

2. The Riga Car Building Plant:

2.1. When developing new electric and diesel trains ought to envisage built-in means of the monitoring and diagnosis of the critical assemblies and units of trains on the basis of modern information-computer systems with the transmission of the results of the diagnosis to the automated control system.

2.2. When designing new types of motor coach rolling stock ought to direct special attention to the decrease of its weight by the use of light-weight alloys, roll-formed sections and polymeric materials. Ought to improve the system of automatic brakes on diesel trains, for the purpose of the significant shortening of the braking distances. Ought to envisage for the production of car bodies the use of materials which do not require painting.

3. The Riga Car Building Plant and the REZ Production Association when developing new types of electric trains ought to envisage systems of thyristor-pulse starting and regenerative-rheostatic braking on the basis of modern electronics.

4. The Latvian Maritime Shipping Company:

4.1. Ought to gradually update the fleet with modern highly efficient specialized ships: container ships, Ro-Ro ships, refrigerator ships and chemical carriers.

4.2. Ought to use computers more extensively in the management of transportation facilities.

4.3. Ought to decrease the unproductive idle times of ships and other means of transportation by the introduction of the container and the Ro-Ro systems.

4.4. For the assimilation of the capacities for the handling of 1 million tons of cargo in the container area of the Riga Commercial Seaport ought to built by 1989 railroad sidings on Kundzinsala Island.

4.5. For the assurance of the increasing export of petroleum products ought to carry out the renovation of the Ventspils Petroleum Handling Terminal and the berths of the petroleum port of the State Committee for the Supply of Petroleum Products and Fuel.

4.6. Ought to enlarge the area of the use of secondary heat and fuel energy resources.

5. The Latvian Administration of Civil Aviation:

5.1. Ought to introduce by 1990 the complete mechanization of loading and unloading operations. Ought to Bring the Riga Airport up to the level of an exemplary one in the level of mechanization.

5.2. Ought to improve flight operations support in case of low visibility and the deterioration of weather conditions, having equipped airfields for these purposes with the appropriate landing aids.

5.3. Ought to develop package transportation, first of all on An-26 aircraft.

5.4. Ought to give more extensive assistance to the national economy and first of all to agriculture. Ought to introduce a modern technology of the loading of fertilizers onto an aircraft.

5.5 Ought to broaden the use of automated control systems in case of the selling of plane tickets (Sirena-2) and the management of the production operations of the Riga Airport.

6. The Latvian SSR Ministry of Motor Transport and Highways:

6.1. Ought to improve during the 12th Five-Year Plan the structure of the truck fleet, for which:

to achieve the optimum ratio of the share of especially heavy trucks (8 tons), heavy and medium trucks (5-8 tons) and light trucks (2-5 tons);

to increase the number of trailers and semitrailers (1-1.5 trailers and semitrailers per tractor);

to increase the production of dump trailers;

to increase significantly the share of the diesel-powered fleet.

6.2. Ought to develop in every possible way centralized transportation.

6.3. Ought to introduce scheduled service.

6.4. Ought to expand the transportation of freight in universal containers.

6.5. Ought to expand the transportation of freight in packaging.

6.6. Ought to decrease the above-standard layovers of motor transport for loading and unloading, for which to set up traffic control centers at large cargo-forming facilities.

6.7. Ought to continue the elaboration of efficient timetables of bus traffic and schedules of the departure of taxis on the basis of the study of passenger flows.

6.8. Ought to introduce in operation of buses of large and extra large capacity.

6.9 Ought to improve the structure of the management of the production processes of transportation, the maintenance and repair of rolling stock, by setting up the corresponding centers of operational management with the use of computers.

6.10. Ought to expand, renovate and modernize the production bases of motor transport enterprises and motor vehicle repair plants with the use of means of the diagnosis of the technical condition of motor vehicles, the mechanization of manual and labor-intensive operations.

7. The Administration of the River Shipping Company of the Latvian SSR Ministry of Motor Transport and Highways:

7.1. Ought to introduce during the 12th Five-Year Plan modern combined river-sea ships.

7.2 Before 1990 ought to improve the Riga River Port, having ensured the possibility of receiving and processing sea-going ships with a draft to 6 m, which deliver crushed granite to Riga.

7.3. Ought to ensure by 2000 the increase of the freight turnover in the regions of the river port of Nizhniy and Verkhniy Voler and Zvirgzdusala to 5 million tons by the introduction of new loading and unloading devices and other modern equipment.

7.4. Ought to introduce by 1995 at the ship repair yard a slip, which ensures the possibility of the repair on it of river-sea ships with a tonnage of 3,000 tons.

7.5. Ought to complete in 1986 the changeover to the brigade form of the organization and remuneration of labor in the passenger transportation and technical fleets, as well as of workers in loading and unloading operations.

In the Area of Scientific and Technical Progress in the Sphere of Service

1. The Latvian SSR Ministry of Trade, the Latvian SSR Union of Consumers' Societies, the Latvian SSR Ministry of the Fruit and Vegetable Industry, the DOVURS [not further identified] of the Baltic Railroad, the Commercial Maritime Transportation Administration, trade enterprises:

1.1. Ought to continue during the 12th Five-Year Plan the complete rationalization of enterprises of retail and wholesale trade, public dining and warehousing services, devoting particular attention to the mechanization of technological processes.

1.2. Ought to improve the work on the improvement of the management of trade on the basis of the extensive introduction of automated control systems and computer technology.

1.3. Ought to introduce more extensively the experience of the trade organizations of the city of Daugavpils in the implementation of the intersectorial program on the decrease of manual labor.

1.4. Ought to increase constantly the level of the industrialization of public dining, use more efficiently the available capacities for the production of convenience foods.

2. The Latvian SSR Ministry of Trade ought to consider the question of speeding up the construction of the second section of the Torgtekhnika Production Combine in order to ensure the significant increase of the quality of the repair of refrigeration and technological trade equipment and to expand the production of means of small-scale mechanization.

3. The Latvian SSR ministries of the food, the meat and dairy industries, the fruit and vegetable industry and procurement ought to ensure during the 12th Five-Year Plan the significant increase of the deliveries of goods for trade in packaged form in packaging.

4. The Latvian SSR Ministry of Motor Transport and Highways ought to continue the work on the equipment of trucks with lift gates. Ought to meet more completely the needs for them of enterprises of the sphere of services.

5. The Latvian SSR Ministry of Consumer services, enterprises and organizations:

5.1. Ought to carry out the technical equipment and retooling of enterprises on the basis of a set (systems) of machines and instruments, advanced technological processes, the use of special vehicles.

5.2 Ought to continue the work on the introduction of advanced types and forms of service of the population, which are aimed at the increase of the standards of service, the quality of the services being rendered and the decrease of the time expenditures of the consumer on obtaining them.

5.3. Ought to step up the work on the introduction of advanced low-waste and resource-saving technological processes, modern types of basic and auxiliary materials, equipment, metering and automatic control instruments for the assurance of the saving of all types of resources and the decrease of the cost of services.

5.4. Ought to ensure by the end of the 12th Five-Year Plan the enlargement of the range of produced means of mechanization and nonstandardized equipment with the simultaneous increase of their quality and the more complete meeting of the needs of the sector for them.

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GENERAL

ACADEMICIAN MARCHUK ON INTENSIFICATION OF ECONOMY

Moscow PARTIYNAYA ZHIZN' in Russian No 1, Jan 85 pp 30-36

[Article by Academician G. Marchuk, deputy chairman of the USSR Council of Ministers and chairman of the USSR State Committee for Science and Technology: "The Basis of the Intensification of the Economy"]

[Text] The changeover of the economy to the path of intensification, as was emphasized at the October (1984) CPSU Central Committee Plenum, can be achieved only on the basis of scientific and technical progress. A specific program of actions on the rapid changeover of social production to the path of intensive development, on the efficient use of the immense production and scientific potential of our state and on the implementation of the unified scientific and technical policy is contained in the decisions of the 26th party congress and the subsequent CPSU Central Committee plenums.

Science and technology of our times are becoming more and more important factors of social progress, ensuring appreciable changes not only in the sphere of physical production, but also in the control of social processes. "The retooling of sectors and the introduction of the latest achievements of science and advanced know-how," Comrade K. U. Chernenko notes, "are acquiring particular importance at the present stage. This is an urgent requirement of the times, one can say, a command of the age."

In the next few years we have to produce machines, equipment, instruments and materials, which have indicators of the highest world level, and to increase labor productivity in all the sectors of the national economy. It is possible to achieve this, if fundamentally new types of equipment and processing methods are developed, the retooling of production, complete mechanization and automation are carried out constantly and on an ever increasing scale, the level and effectiveness of scientific research work increase. It is important to expand scientific and technical cooperation with the socialist countries, the practice of which is based on the principles of fraternal assistance, equality and reciprocity, as well as to develop fruitfully trade and economic ties and scientific and technical ties with all states which display a willingness for this.

The scale of the national economic tasks forces us to look in a new way at the process of implementing the results of scientific developments and to

persistently improve the forms and methods of the planning, financing and estimation of the expenditures of social production. If we look at the problem of the development of science and technology from a broader standpoint, then, as Comrade K. U. Chernenko noted, the state of affairs in this area arouses some anxiety. Therefore the Politburo deemed it necessary to examine at the next CPSU Central Committee plenum the questions of the acceleration of scientific and technical progress and the improvement of its management in all the units of the economy.

The intensification of the economy and the increase of its efficiency in many ways are dictated by the use of advanced technological processes. Today in our country several thousand descriptions of machines, instruments and apparatus are assimilated annually. There are significantly fewer technological processes--about 100. But among them there are only tens of fundamentally new ones. Meanwhile the greatest national economic impact, which is measurable in terms of the final product of production, is obtained owing to new processing methods. Their payback now on the average is equal to 1 year.

The distinctive features of advanced modern processing methods are the small number of operations, continuity, the decrease of the expenditures of materials, energy and manpower resources, the reduction of losses and waste products, the automation of the control of processes in a set mode and their optimization with the aid of computers. In the extractive sectors the outlined changeover to new methods and means of increasing the recovery of petroleum from formations, the production of coal, nonferrous metals and other minerals will make it possible to increase by 15-20 percent the output of useful raw materials. The use in metalworking of parts, which are made from powders, saves per ton of them 2 tons of rolled products and frees up to 80 metal-removal machine tools and about 200 highly skilled workers. The application of coatings made from powders decreases to nearly one-fourth the losses of metal from corrosion and increases the strength of items and their service life. The use in designs of machines of new modern instruments, computer equipment, high-strength and heat-resistant materials, materials, which resist corrosion well, and other advanced materials is increasing.

The analysis of domestic and foreign experience shows that the time spent on the production of items in machine building in many cases makes up a smaller portion of the production cycle. Various types of intrashop and intershop transportation, warehousing and control operations and unjustified organizational and technical delays account for the remaining time. Hence it follows that the improvement of the technology of basic production does not yield the desired result without the complete automation of the entire technological chain, without the increase of the degree of continuity of the production process as a whole.

Approximately three-fourths of modern machine building is of a series and small series nature. The rapid updating of the products list requires the prompt reorganization of production at enterprises. But it turns out that the organizational and technical means, which are effective in case of the automation of production with a single products list, become a hindrance in case of the updating of products. Life has suggested a way out of this

situation. The future is with versatile, rapidly adjustable production systems. Industrial robots, that is, automatic manipulators with programmed control, will hold a significant place here. They will replace people in difficult and harmful jobs and will make it possible in many operations to automate manual labor. Robots together with other modern equipment are opening the way to rapidly adjustable production modules--the basic units of automated sections, shops and entire enterprises, which are controlled by computers. During the current five-year plan our national economy will receive more than 100 models of automatic manipulators and technological complexes of the "equipment-manipulator" type, which have been built according to the unitized modular principle with the use of microprocessor equipment.

Versatile automated production systems, which are based on the combination of robotized complexes, transportation and warehousing equipment and computer technology, are an example of the organization of enterprises of the immediate future. Precisely here the means of automation, which are linked together, yield a impact, which has been increased by many fold, and make radical changes in the technical level of production.

The acceleration of scientific and technical progress, of course, is also inconceivable without the improvement of the economic mechanism, without the stimulation of the development, assimilation and introduction of new equipment. It is necessary to raise the elaboration of the questions of the economics of scientific and technical progress to a qualitatively new level, which corresponds with the changeover of the national economy to the intensive means of development. Without going into the details of these most complicated problems, I want to note the main thing: if the fruits of new developments do not become widespread, the economic impact from an innovation not only is small, but might also not exist at all. In other words, even the most advanced new equipment and, hence, the corresponding scientific and technical development cannot be efficient, if the necessary scale of introduction is not ensured. That is why these questions should be examined especially carefully when formulating the national economic plans.

Further, until recently the plan indicators on new equipment and the technical level of production were not grouped with the decisive ones. This had the result that enterprises frequently offset the nonfulfillment of the plan on these items by the increase of the output of previously assimilated, or else obsolete products. Now the basic fund-forming indicators will be closely coordinated with the technical level of the output being produced and of production itself. Specific steps on the stimulation of the development of new, highly productive equipment, including by the establishment of incentive markups which can amount to 30 percent of the wholesale price, have also been outlined. The methods and the very practice of setting the prices for new products for production engineering purposes need improvement. Here, it seems, it is necessary to direct attention to a significantly greater extent than today to the technical and economic parameters of new equipment, its consumer properties and the economic impact from use in the national economy.

The economic experiment on the increase of the independence of enterprises and associations, which is being conducted in five sectors of the national economy and the scale of which beginning in January 1985 is being significantly

expanded, promises much. The coordination of the fund-forming indicators of enterprises with the amounts of the national economic profit from the sale of the output being produced is also included among the most important tasks of the experiment. The strengthening of the influence of pricing on the stimulation of scientific and technical progress is the lever, which will make it possible to expedite what is new and advanced and to make the way easier for them.

But I would like to stress that only processing methods, which are based on major basic research and scientific discoveries, make revolutionary changes in the economy. Let us recall, for example, that the new sector of industry--specialized electrometallurgy--originated owing to the technology of electroslag welding. Ultrahigh pressures and high and ultralow temperatures have become firmly established in the arsenal of machine building. Precisely under these extreme conditions it is possible to effect changes of substances, which are inconceivable within traditional processing methods. The technical use of another noteworthy discovery of our century--superconductivity--is affording truly unlimited opportunities for the development of power engineering and electrical engineering.

The history of science abounds in examples of how discoveries in one field of it generate discoveries in another. This feature of scientific creativity at the same time also reflects the present trend of scientific and technical progress: individual achievements in various areas help to find unexpected solutions of a problem in general or, taken together, yield something new, which is greater than the sum of its components, and at times also leads to entirely unpredictable finds.

Indeed, since theoretical research (at least at its initial phase) is aimed at the discovery of the essence of one phenomenon or another, at the obtaining of information about it, and not at the solution of specific practical problems, the results of the practical use of discoveries can by unforeseen. For example, the study of the theory of combustion--a most ancient process, in which, it would seem, everything was already known--led to an unexpected result--the discovery of what is called a "solid flame" and, further, to the development of the technology of synthesizing the most valuable high-melting compounds. There are already facts which give reason to hope that the interconnection of scientific research work in biochemistry, bioorganic chemistry and molecular genetics will lead not only to substantial advances in medicine and the development of fundamentally new medicines, vaccines and antigens, but also to the control of heredity.

I would like to emphasize here the most general thing: major fundamental ideas sooner or later find without fail their own means of practical expression, "their own" technology, through which these ideas, discoveries and the inventions following them begin to have an influence on the process of economic growth.

It can be said without any exaggeration that today we have a sufficient number of advanced scientific ideas. Their continuous "production" is ensured by the entire system of scientific research institutions of the country, and first of all the institutes of the USSR Academy of Sciences and the academies of

sciences of the union republics. However, the rapid embodiment of ideas in technological processes frequently does not occur. Such a situation is bringing to the forefront a large number of important organizational problems.

The means of their solution were specified by the November (1982) and June (1983) CPSU Central Committee plenums and were rendered concrete in the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy." In essence, this marks the beginning of a fundamentally new approach to the problems of the acceleration of scientific and technical progress, the reorientation of priorities in the system of economic indicators and the determination of the basic directions which are connected with the introduction of new processing methods.

One of the most serious problems, which we have to solve in the next few years, is to learn to purposefully concentrate the technological potential. Today the historically formed fragmentation of design bureaus and scientific research institutes in many sectors of industry and the lack of powerful technological centers are becoming an obstacle in the way of the pursuit of the unified scientific and technical policy. This is particularly noticeable when the question of the use of important intersectorial processing methods, which have one common feature--they cannot be implemented by some sector alone--arises. Here we are confronted with a contradictory situation. On the one hand, the process of the consolidation and complication of scientific and technical problems and their going beyond the framework of individual sectors are becoming a more and more decisive trend of development. On the other, the potential of sectorial science, for its most part, is dispersed according to the sectorial principle. Scientific organizations and scientific production associations are subordinate to ministries. They set tasks for their research institutions, approve the themes and provide the financing, taking into account first of all the interests of the sector.

Under such conditions the attempts of sectors to set up independently the development and extensive introduction of plasma, laser, powder, welding and other processing methods, coming up against departmental barriers, lead to duplication and parallelism. It also happens that no one at all deals with an intersectorial processing method, which could benefit the entire national economy, precisely because it is in a "no man's land."

Therefore the organization of a system of intersectorial scientific production engineering, which stands above departmental barriers, is becoming one of the most important tasks in the present organization of the "science-production" process. We have many examples of the successful solution of difficult complex problems, as was the case, for example, in the origination of atomic energy or space technology. There appeared here powerful intersectorial scientific and technical complexes, which are capable under united management to solve all arising problems--from the conducting of the necessary basic research to the organization of industrial production. And to do this regardless of departmental subordination.

Today this applies first of all to the firm establishment of the goal program method of the planning of the development of science and technology, which

received concrete embodiment in the decisions of the party and government on measures on the acceleration of scientific and technical progress. At present a planned system of scientific and technical programs--at the state, intersectorial, sectorial and regional levels--is operating in the country on their basis. These programs--and in all there are 170 of them--encompass a wide range of interdepartmental research and development in the area of the fuel and power and the agroindustrial complexes, machine building, the chemical industry, metallurgy, transport, public health and consumer goods production.

The CPSU Central Committee approved of the work being performed by the Leningrad Oblast Party Committee on the increase of the intensification of the economy on the basis of the acceleration of scientific and technical progress. The implementation of the set of measures outlined by the Leningraders will make it possible to increase significantly the rate of development of the economy, to reduce the materials-output ratio and the product cost and to decrease the share of workers who are employed in the performance of manual and auxiliary operations. By means of the increase of labor productivity it is planned to obtain in the oblast during the next five-year plan the entire increase of the production volume; with respect to the majority of types of output being produced to attain the level of the best Soviet and world achievements.

Diverse advanced forms of the integration of science and production, which are contributing to the successful solution of intersectorial problems, have arisen in a large number of scientific centers and regions of the country.

One of them is intersectorial scientific production cooperation as a voluntary service. For example, on the initiative of the Lvov Oblast Committee of the Ukrainian CP and the Western Scientific Center of the Ukrainian SSR Academy of Sciences interdepartmental special-purpose scientific production associations have begun to operate. They are set up on a contractual basis by the participants in the goal programs which are approved by the corresponding ministries. So-called interdepartmental scientific production complexes are organized within the framework of the contract. Their task is to coordinate the activity of interdeparmental associations, which are close in specialization, to direct the formulation of goal programs and the set up new interdepartmental associations. A collegium, of which representatives of the corresponding associations and party and soviet workers are members, manage the activity of the complex; a prominent scientist usually heads the collegium. This experience is reflected in the article of First Secretary of the Lvov Oblast Committee of the Ukrainian CP V. F. Dobrik "The Party Committee and the Introduction of Scientific and Technical Achievements," which was published in No 11 of the journal PARTIYNAYA ZHIZN' for 1984.

At the Belorussian SSR Academy of Sciences the Central Design Bureau with a pilot works and eight affiliates of it, which "work" for the institutes of the physical technical and physical mathematical type, were set up into order to obtain the opportunity for the quicker testing of fundamentally new scientific and technical ideas. Their experience proved to be fruitful, and several of these affiliates have already been transformed into independent organizations attached to academic institutes. Now the Belorussian scientists have, in

addition to the Central Design Bureau, another seven special design and design and technological bureaus with pilot works.

Several interdepartmental physical technical laboratories, which unite the scientific potential of academic institutes with the technological possibilities of industrial scientific research institutes and scientific production associations, have been operating successfully for several years now at the institutes of the Siberian Department of the USSR Academy of Sciences and at a number of other institutions of the USSR Academy of Sciences and the academies of sciences of the union republics. Their activity was essential when developing new processing methods and devices of microelectronics.

Today several academic institutes and scientific centers are successfully performing the functions of intersectorial and scientific and technical centers, which have a decisive influence on the development of entire fields of technology. Thus, it is generally acknowledged that the level of the mechanization of welding operations in the USSR exceeds the indicators of foreign practice. And this was achieved to a significant extent owing to the efforts of the Institute of Electric Welding imeni Ye. O. Paton of the Ukrainian SSR Academy of Sciences. The institute is now taking part in 12 comprehensive programs, which are being fulfilled in the interests of large industrial associations, ministries and regions, as well as 11 all-union and republic goal programs. Moreover, it took part in the solution of more than 20 most important scientific and technical problems. Several large-scale operations, which are being performed under the aegis of this institute, have led to the radical change of technological processes and even to the establishment of new sectors of industry. The total national economic impact from the use of the results of the developments of the Institute of Electric Welding, which were performed in cooperation with other enterprises and organizations, exceeds 150 million rubles annually. This is connected first of all with the fact that due to its own powerful production base the institute is able to bring basic research up to the production level.

In recent years a qualitatively new form of the combination of basic research with planning and design operations and production has emerged in the Ukraine. Large scientific and technical complexes, which consist of an institute, a design bureau, an experimental works and a pilot plant, have been set up on the basis of the leading institutes of the Ukrainian SSR Academy of Sciences. The Presidium of the Ukrainian SSR Academy of Sciences came forth with the proposal to develop on their basis a new organizational form--academic scientific and technical associations (ANTO's), which will carry out all the stages of the "research--pilot production--introduction" process. The already gained experience of the work of the scientific and technical complexes confirms that owing to their academic, and not sectorial, subordination it is possible to surmount departmental barriers significantly more easily when solving intersectorial problems. The fact that the scientific research institutes of the complexes are the main organizations in the country for the directions being elaborated, to a significant extent is also conducive to this.

The most convincing evidence of the fact that the establishment of intersectorial organizations has become a ripe necessity, is their nearly simultaneous emergence in various union republics. The development is proceeding not in the same manner, and each experience is valuable. The task is to select the best organizational solutions.

For example, in Belorussia the Scientific Production Association of Powder Metallurgy, which is directly subordinate to the Belorussian SSR Council of Ministers, was set up. It has a pilot works, an experimental base and other subdivisions. Such a structure enables this scientific production association to carry out scientific research, the development and introduction in production of new technological processes and to organize the production of the latest construction materials. With its assistance 8 sections of powder metallurgy have been organized at enterprises of Belorussia, while at the production testing ground of the association powder and laminated composite materials are being produced for 12 ministries of the country. The level of the technical developments of the scientific production association corresponds to the foreign analogues or is superior to them.

The original experience of the Latvian SSR is of interest. The cost accounting introducing and intermediary organization ORIONT (the department of the development and production of models of new equipment) is operating successfully here. Its purpose is to give assistance to inventors and efficiency experts of various enterprises, as well as to scientific organizations which do not have their own design bureaus and pilot works. The result: 95 percent of the total number of developments, which were carried out by ORIONT, as a rule, are introduced very quickly in production. The principle of the planning of the current work of this organization is also interesting. The Science and New Technology Department of the republic State Planning Committee formulates its thematic plans. The basic condition of the inclusion of a theme in the plan is the principle of maximum utility to the national economy. Over several years the organization has filled difficult orders for 10 sectors of industry and institutes of the Latvian SSR Academy of Sciences.

An intersectorial association of a different type--an industrial association--was set up in the RSFSR. This is the republic Transprogress Industrial Association for Pipeline Container Transport, which is directly subordinate to the RSFSR Council of Ministers. It originated on the basis of the domestic invention of a system of container pneumatic transport. By means of "capsules" on wheels, special seals and the independent suspension of the containers it is possible to convey any, even large-tonnage cargoes through tubes of different diameter by air thrust with the speed of a metro train. This system of transportation can compete successfully with dump trucks and railroad on short hauls, that is, everywhere that a constant stable flow of freight is required. The pipeline, moreover, can be laid by the shortest route--on the ground, under buildings, on supports. Calculations and experiments show that, for example, the introduction of 100 Transprogress automated systems with a length of 10-12 km, which are capable of transporting 3 million tons of bulk freight a year each, can provide an annual economic impact of 190 million rubles.

Another direction of the use of powerful container systems is the removal of household waste from large cities. The adjustment of the Transprogress system, which was established for the removal of household waste from Moskovskiy Rayon to the garbage-processing plant, is now under way in Leningrad. The third direction of the activity of Transprogress is the development of systems of intraplant transport. They will be able to interconnect the shops of enterprises and to transport any freight through tubes.

As is possible to judge from the foregoing, the sphere of activity of Transprogress is broad and nontraditional, the principles of its activity are also nontraditional. Let us recall that today a large number of transportation ministries are involved in the transportation of freight. Transprogress assumes the functions of all organizations, moreover, from the production of systems of pipeline transport to their operation. In large systems the association will set up production sections and serve consumers on the basis of full reimbursement. The main commercial indicator is the transportation of a ton of freight. All the "superstructures," including production, in the association should exist subject to this "final product." Therefore Transprogress is economically interested in the decrease of expenditures and the reduction of personnel throughout the chain of the birth and operation of the system. Such a feature of the industrial association is attaching extreme interest to the experiment being conducted in the RSFSR.

In Georgia today's highest form of the association of intersectorial organizations--the Georgian SSR State Committee for Special Transportation and Systems for Its Automation (the Georgian SSR Goskomspetstrans)--has been established. Its distinctive trait is that everything: from the origination of a novelty to its realization, is concentrated in the hands of one organization. The state committee assumes the functions of a single client for the development or copying of specialized types of transport--cable, container, monorail and pipeline. The consumer receives the finished system "turnkey." The Georgian SSR State Committee for Special Transportation and Systems for Its Automation provides everything else--the performance of the necessary scientific research, surveying, planning and design and construction work, the delivery of equipment, its installation, adjustment and operational maintenance. For this within the state committee, in addition to main administrations, there are a scientific research and experimental design institute with an experimental production base, two mobile mechanized columns and an educational combine for the training of personnel.

The cited examples make it possible, in our opinion, to state first of all the following opinion of a general order. The more important and fundamental a problem is, the less compatible it is with any departmental boundaries. And since this is so, it is necessary to seek new means of integration of all the participants in the "science--technology--production" process.

In the very next few years we have to improve significantly the entire mechanism of the management of scientific and technical progress. This work should include both organizational means and the formulation of plans and methods and the implementation at enterprises, associations, every workplace and in all scientific collectives of specific, scientifically sound steps on

the increase of production efficiency. In other words, the acceleration of scientific and technical progress depends first of all on the active and extensive involvement in this of all the participants in the "science--technology--production" cycle. Here much depends on initiative, the vocational training of communist scientists, the pugnacity of party organizations and the ability to put to use what is figuratively called the human factors of scientific and technical progress--enthusiasm, daring, the depth of theoretical thinking, the boldness of engineering thought, the patriotic aspiration of the Soviet people for the increase of the effectiveness of their labor.

There is no doubt that the current decade will become a stage of the extensive, large-scale embodiment of basic scientific results in practice, a period of the mass introduction of those achievements of scientific, technical and management thought, which will make revolutionary changes in production and will make it possible to solve successfully the key national economic problems.

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GENERAL

BOOK ON STIMULATING PROGRESS IN MACHINE BUILDING

Kiev EKONOMIKA SOVETSKOY UKRAINY in Russian No 9, Sep 84 pp 85-86

[Review by Corresponding Member of the Ukrainian SSR Academy of Sciences P. Verba of book "Stimulirovaniye nauchno-tekhnicheskogo progressa v mashinostroyenii" [The Stimulation of Scientific and Technical Progress in Machine Building] by V. P. Babich, "Tekhnika", Kiev, 1983, 112 pages (Kharkov): "Economic Levers and Stimuli of the Acceleration of Scientific and Technical Progress"]

[Text] The policy of the intensification of social production and the acceleration of the introduction of scientific and technical achievements in production is a peculiarity of the present stage of the development of the economy of the country. At the same time, as is indicated in the decree of the CPSU Central Committee and the USSR Council of Ministers "On Measures on the Acceleration of Scientific and Technical Progress in the National Economy," in many ministries and departments, at associations and enterprises the responsibility for the technical level of production and product quality is inadequate, the developments of academic institutes and sectorial scientific research institutes and design bureaus, which, in turn, are inadequately interested in the acceleration of the "science-production" cycle, are being poorly utilized. In the set of measures, which are being implemented in the country on the acceleration of scientific and technical progress, an important place belongs to the further improvement of economic stimulation.

The monograph under review,[1] which is devoted to the solution of urgent problems of the improvement of the mechanism of the stimulation of scientific and technical progress, makes a definite contribution to the systematization of the knowledge on the structure of this mechanism and proposes a quite thorough model of the structure in matrix form, which serves as a tool of the comprehensive goal approach to the solution of the problems of stimulation.

The author of this work set the goal to reveal the set of stimuli of the basic stages of the "science-production" cycle. This found reflection in the differentiation of both the proposed principles of the evaluation of activity and the methods of the material stimulation of collectives which realize the functions of scientific and technical progress at various stages. The

theoretical and practical importance of the basic methodological premise of the author--the stimulation not of individual scientific and technical developments, but the increase of the efficiency of the activity of the scientific, technical and production collectives, which are responsible for the elaboration, development and use of scientific and technical achievements--should be noted. The recommendations of the author are an entire set of forms and methods of the stimulation of the overall increase of the scientific and technical level of research and development and the technical level and efficiency of production.

The author makes a definite contribution to the theory and practice of the use of the law of distribution according to labor. In the book studies and elaborations on the improvement of the distribution of both the necessary and the surplus product are made. The advanced know-how of the planning of wages is generalized, the dynamics of the average wage of different categories of working people, with respect to the level of the remuneration of the labor of engineering and technical personnel and workers and of scientists and workers is analyzed. The correct conclusion about some weakening of the stimulating function of the wage in the sphere of science and scientific service is drawn, valuable suggestions on the increase of the influence of the wage of scientific and engineering personnel on the increase of the end national economic results are given.

The presentation of the results of the author's research on the improvement of the distribution of the surplus problem takes up considerable room in the work. Basically these are questions of stimulation through the category of bonuses which are paid at the expense of the profit. It is necessary to rate positively the attempt to accomplish the difficult task of improving the methods of the formation and distribution of economic stimulation funds at scientific research institutes, design bureaus and enterprises. The method presented in the work of the factor distribution of the material incentive fund among the structural subdivisions subject to their contribution to the increase of production efficiency merits attention.

In the recommendations on the improvement of the special-purpose payment of bonuses for new equipment attention should be directed to the topicality of the proposals on the linking of the amounts of the bonuses of management, scientific, engineering and technical personnel with the end results of scientific and technical progress. The author substantiates the principles of the payment of bonuses and proposes indicators and conditions of the payment of bonuses and methods of the construction of scales of the payment of bonuses with allowance made for the coefficients of the intensity of the labor of developers and the progressiveness of the equipment and technology being developed by them.

The problems of the stimulation of scientific and technical progress and the increase of the stimulating role of the evaluation of the activity of scientific, engineering and technical collectives and individual workers received creative development in the book. The elaborated system of the evaluation of the collective contribution (through the evaluation of the activity of the structural subdivisions) and the individual contribution

(through the evaluation of the quantity and quality of the invested labor) is distinguished by a strict logical nature, while the completeness on the procedural level makes it possible to recommend it for introduction in the practice of scientific research institutes, design bureaus, associations and enterprises of industry.

Sufficient space is devoted to the questions of revealing the essence of the stimuli of scientific and technical development in the mechanism of summarizing the results of socialist competition. Here the correct approach to the determination of the indicators of the socialist competition of the collectives of structural subdivisions, which in combination characterize the scientific, technical, economic and social end results, should be noted.

The revelation of the essence of the stimuli, which are incorporated in the plan assignments for enterprises and organizations on new equipment, merits attention. The author focuses attention on the need for the evaluation of the intensity of the plan assignments on the increase of the technical level of production and the corresponding distribution of bonus assets to collectives and technical supervisors.

The procedural approaches and recommendations on the improvement of the remuneration of the labor of developers of new equipment, which are proposed in the book of V. P. Babich, make it possible to link the amounts of bonuses more completely with the end results of the technical development of production and the improvement of the new equipment being developed. The author made a significant contribution to the development of the procedural principles of the economic stimulation of the activity of sectorial scientific research institutes and design bureaus under the conditions of the intensification of production, having proposed a system of the evaluation and material stimulation of collectives on the basis of the indicators which characterize their influence on technical progress in the sector.

While noting the value of the book under review as a whole, attention should also be directed to its shortcomings. Thus, it would have been advisable to present in generalized form the experience of the socialist countries in the stimulation of scientific and technical progress. The questions of the specific nature of the stimulation of temporary scientific and technical collectives, which are set up for the solution of individual important problems, also did not find reflection. A large group of problems of stimulation, which are connected with the regional management of scientific and technical progress and its combination with sectorial management, was also reflected quite sparingly in the work.

As a whole, the work is of interest for scientists and management personnel of industry. It is useful to all economists and students, since it reveals the means and methods of solving many urgent problems of the acceleration of scientific and technical progress.

FOOTNOTE

1. V. P. Babich, "Stimulirovaniye nauchno-tekhnicheskogo progressa v mashinostroyenii" [The Stimulation of Scientific and Technical Progress in Machine Building], Kiev, "Tekhnika", 1983, 112 pages.

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