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USSR Report

ECONOMIC AFFAIRS

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ECONOMIC POLICY, ORGANIZATION AND MANGEMENT

CAREFUL MANAGEMENT OF SCIENTIFIC-TECHNICAL PROGRESS ADVOCATED

Efficiency of New Equipment

Moscow VOPROSY EKONOMIKI in Russian No 1, Jan 80 pp 27-38

[Article by L. Gatovskiy, corresponding member of the USSR Academy of Sciences: "Management of the Efficiency of Scientific and Technical Progress"]

[Text] Improvement in the projection, planning and stimulation of the growth of efficiency of new equipment and in the material, financial and organizational facilities for this growth is a significant factor in an increase in the efficiency of all social production. Therefore, determination of the ways of solving these problems at the present stage occupied one of the important places in the decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Intensifying the Effect of the Economic Mechanism on Enhancing the Efficiency of Production and the Quality of Work." Let us dwell on some trends in the implementation of the indicated decree in connection with the above-mentioned problems of managing the efficiency of new equipment.

Enhancing the Efficiency and Quality of New Equipment at the Stages of Its Selection, Production and Utilization

As the maturity of the socialist economy increases, the requirements on the level of efficiency and quality of new equipment rise considerably. However, these requirements, which are objectively determined by the development of the economy, are not yet realized sufficiently.

According to the Methods (Basic Principles) of Determination of the Economic Efficiency of New Equipment, its ability to surpass the indicators of the efficiency and quality of the best foreign equipment and that designed in the USSR and, if such planned studies are not available and if it is impossible to utilize foreign experience, to surpass the best indicators of similar equipment already available in the USSR is the condition for its introduction into production. The methods proceed from the superiority of new equipment over equipment "having the lowest reduced

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expenditures per unit of output (operation) turned out by means of this equipment" (ibid, paragraph 10). These requirements are considerably lower in the Basic Principles of the Procedure for the Certification of the Output of Machine Building and Other Industrial Sectors. The highest quality category and the Badge of Quality are also conferred on articles (including new equipment) if they do not surpass the indicators of the best available models, but only correspond to them.

With regard to new output (including new equipment), according to the data of the All-Union Scientific Research Institute of Standardization, in 1978 much less than one-half of the new types of articles were included in the highest quality category.¹ Meanwhile, GOST /All-Union State Standard/ 15.001-73 establishes that output subject to introduction into production should meet the requirements placed on the highest quality category. Thus, the present requirements on the level of efficiency and quality of new equipment are not fulfilled, which attests to the insufficient efficiency of the mechanism of their implementation in the practice of planning and management. Such a mechanism must be set up on the basis of the July (1979) decree of the CPSU Central Committee and the USSR Council of Ministers.

It is primarily a matter of a realistic implementation of the following principle: As a rule, each type of new equipment should meet the level of the highest category of the quality of output in accordance with the requirements on the selection of high-quality new equipment contained in the methods of determination of the economic efficiency of new equipment and in the principles of the certification of the quality of output.² It is important to specify the conditions of conferment of the highest quality category, coordinating them with social and economic efficiency, and to systematically exercise the strictest, according to the decree of the CPSU Central Committee and the USSR Council of Ministers, control over the observance of the required conditions. For an actual guarantee of the fulfillment of this principle it is necessary to create organically coordinated economic and organizational prerequisites.

Ensuring in scientific research institutes and technical units sufficiently important advantages for the development of subjects of major national economic significance should play a paramount role for the subsequent selection of highly efficient equipment. As is well known, the decree opens up great opportunities for intensifying the incentives for the development and output of such equipment.

With the absolutely positive role of the development of economic accountability in scientific research institutes and technical units and with the transition to paying for them according to completed studies, there is a need for efficient measures to overcome the still widespread relative "advantage" of minor subjects directed toward negligible inefficient corrections for obsolete equipment, not toward a significant qualitative renovation of production. Owing to the difference in the time and extent

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of stimulation, preference can be given to minor subjects, because they are realized, paid for and stimulated much more rapidly than major subjects (with longer periods of performance and completion of studies and their implementation in the presence of significant search elements, a certain risk with regard to a guaranteed derivation of the envisaged results and so forth). That is why it is important, on the basis of the payment to scientific research institutes and technical units for completed studies, in practice, to ensure prompt preferential incentives for the development of major subjects as they are executed (within the estimated cost of work) at the expense of internal sources and credit.

The wide dissemination of certification (with provision of a nondepartmental approach) of technical developments, beginning with technical assignments, can become the prerequisite necessary for an improvement in the quality and efficiency of the new equipment selected for introduction into production. In our opinion, the following should be the objects of such certification: direction of developments toward the requirements placed on the highest quality category; substantiation of the plan with the appropriate standards of expenditures, results and periods of realization of both the production and operation of equipment (in particular, detection of cases of exaggeration of the planned effect as compared with the capabilities realistically inherent in it);³ conclusion of the plan, finish of technical specifications, reliability of tests and completion of the experimental model. A mandatory application of the certification of quality to industrial processes and the introduction of the appropriate GOST establishing the system and the procedure for its execution can be a factor contributing to the selection of more efficient, new equipment.

To improve the quality of the selected new equipment, it is important to greatly intensify in its planning the role of technical assignments so that certification may have a prompt effect on the development of highly efficient equipment. This will prevent the shortcomings in development that it is too late to eliminate at the stage of technical specifications. Technical assignments should see to it that a given plan for new equipment meets the level of the highest quality category.⁴

The fact that plans do not take sufficiently into consideration the specific needs of the spheres of consumption often hampers the planning and selection of equipment at such a level. Indicators of new equipment that by no means can be utilized under the specific conditions of this sphere of its operation are planned in a number of cases. For example, often high-quality lathes, or machine tools with numerical program control, are not used with a sufficient load (sometimes 15 to 20 percent) and it is economically more advantageous (in the absence of other varieties of high-quality new equipment, which meet the specific needs of the spheres of consumption to a greater extent) to reject their use owing to inefficiency under these conditions.

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This also attests to the narrowness of the list ("range") of new machine tools, machines, equipment, instruments, apparatus and so forth. In our opinion, in the planning of new equipment there is an urgent need for detailed descriptions and calculations of the specific conditions and needs of each of the basic spheres of operation of given equipment.⁵ At the same time, an economically substantiated expansion of the list of machines and other means of labor, of type sizes and varieties of base models and of their specialized modifications will make it possible to greatly raise the coefficient of utilization of equipment and its quality and efficiency. Such an expansion of the list should be combined with the introduction of systems of machines, with a significant development of the standardization of parts, units and technology and with the overcoming of the serious lag existing here. All this will facilitate, accelerate and lower the cost of the mastering and introduction of new equipment and will diminish the "losses" of the effect at these stages as compared with the level of the effect at the planning stage.

The national economic effect and its real derivation are determined according to the specific spheres of application. Improvement in the quality and efficiency of new equipment means a better satisfaction of specific needs and the attainment of the final result. A lack of the proper consideration of the specific nature of the needs of the spheres of consumption leads to a decline in the national economic efficiency and quality of new equipment. If equipment directed toward the needs, for example, of primarily only one sphere of application has the highest quality category and the needs of other (important) spheres are ignored or not taken into consideration sufficiently, in such a situation some consumers are forced to use not new, but less expensive and more suitable equipment.

Modification of the models of new equipment in accordance with the specific needs of the spheres of consumption presupposes that with regard to these needs new equipment will be planned at the level of the highest quality category. Naturally, however, for adaptation to the need of a given sphere varieties of models of new equipment belonging to the first, not the highest, category can be developed in some cases. Yet, on the whole, the transition to a systematic consideration of the specific nature of the spheres of application in combination with the direction toward the highest category, to be sure, will lead to its much wider dissemination.

Of indisputable interest is the experience of the Moscow Krasnyy Proletariy Machine Tool Building Association in the development on the basis of the base model of the 16K20 screw cutting lathe of a "family" of machine tools intended for various types of production with a reflection in the modifications of machine tools of the specific industrial conditions of a given sphere of consumption. Depending on the specific nature of needs machine tools were equipped with certain additional devices and attachments. Such a "family" of machine tools included more than 40 modifications unified into appropriate groups. An additional output of more than

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1,000 parts included in the modifications of machine tools was prepared. For this purpose the way of development of the unification and standardization of parts, not of a decrease in the technical level of production, was chosen. A total of 425 to 460 parts of the base model were taken for each of the modifications of the machine tool. As a result, the level of unification for a number of models exceeded 90 percent.⁶

Consideration of social needs forms the essence of the program-oriented approach to planning directed toward an increase in the contribution of scientific and technical progress to the final national economic results and toward an improvement in the social and economic efficiency of social production. In accordance with the decree of the CPSU Central Committee and the USSR Council of Ministers there is a need for a mechanism of a real transformation of scientific and technical intersectorial programs, which culminate in the development of experimental models and of the first series of new equipment, into scientific and production programs, which also include the processes of saturating the national economy with this equipment and of retooling the fixed capital of consumers. This will have a significant effect on a rise in the technical and economic level of the national economy, of sectors and of associations (enterprises). Such programs should become the key elements of general economic plans.

The further development of work on the creation of differentiated systems of physical, value and labor standards of both expenditures and of technical, economic and social results is the foundation for an improvement in the management of scientific and technical progress. Standards, being integral elements of the formation of the effect and quality of new equipment, should be systematically calculated in the time aspect in the form of indicators of time saving and in the annual dynamics of this saving within five-year plans. Scientific and technical progress means a systematic increase in the requirements on the standards of reduction in expenditures. At present, however, approximately one-fifth of the production associations and industrial enterprises do not fulfill the plan for lowering production costs. Acceleration of technical progress is the basis for overcoming such tendencies.

Well-organized calculations of standards will serve as an important factor in a successful conclusion of the transfer, scheduled by the decree for 1980, of scientific research institutes, technical units, associations (enterprises) and industrial ministries to the economically accountable system of organization of work on the development, mastering and introduction of new equipment on the basis of schedule-orders (contracts). This is a fundamentally important transition to all-encompassing management of all the units of scientific and production cycles in combination with general economic management. This requires a greater cooperation of the units of scientific and production cycles (from research to the distribution of new equipment) ensuring the following: reduction or elimination of the gaps in time during the transfer of the results of activity of the preceding unit to the next one; simultaneous (parallel) work of allied units on

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the development (utilization) of a given technical article (for example, combination in time of a partial preparation of production with the development of a technical plan); reduction of the length of time of the developments, mastering and introduction of new equipment and of the attainment of the outlined technical-economic and social indicators.

It is especially important to systematically coordinate all-encompassing management according to the schedule-order method with the needs of equipment, that is, to fully include in the schedule-order the final unit--ensuring the best conditions for the utilization of equipment in the spheres of consumption. For this purpose it is advisable to introduce into the structure of schedule-orders supplements directed toward their greater orientation toward the consideration of the needs of the spheres of application of new equipment. It is also advantageous to apply the schedule-order method to intersectorial scientific and production programs. The decree notes the need to direct schedule-orders toward the final results, including toward the national economic effect of new equipment, which is determined according to the sphere of consumption.

The overall approach to the planning and stimulation of scientific and technical progress expressed in all-encompassing management of the cycle "research-technical developments-production of new equipment-its application" according to the schedule-order method should also be applied to the plans (and programs) for the expansion of the technical retooling and reconstruction of sectors and associations (enterprises) outlined by the decree. This task will require the coordination of the rise in the technical and economic level of productive capital (means and subjects of labor), industrial processes and output. Hence the need for a planned combination, directed toward the final results, of intersectorial and intrasectorial relations among the following: a) suppliers of means of production for the output of new equipment, b) manufacturers of this equipment and c) its consumers. The overall nature of the technical retooling of associations (enterprises) will make it possible to eliminate the tendencies toward the underutilization of the effect from new equipment, in which the preservation of obsolete equipment lowers the possibilities for the realization of the effect of new equipment.

The outlined technical retooling of sectors directed toward an increase in the efficiency of scientific and technical progress and all social production places increased demands on the development of machine building, on the improvement in its structure and on the rates of renovation of the output of machinery and equipment. In a number of machine building plants during the last period the proportion (in value) of this production at the age of the first 3 years of output became lower than at the age of 10 years and over.⁷ In 1978 the withdrawal of machinery and equipment (in percent of their pool in terms of value), on the average, throughout the industry comprised 2.4, including in machine building, 2, in the chemical and petrochemical industry, 2 and in ferrous metallurgy, 1.3.⁸ It should also be taken into consideration that, usually, capital repairs do not include the technical renovation of machinery and equipment.

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As a result, technical progress is implemented mainly through the expansion of the pool of equipment, but with regard to the most intensive way, that is, replacement of obsolete equipment with new equipment, there is an obvious lag. An excessive expansion of the pool of equipment, which replaces the processes of technical renovation of existing machines, first, hampers the growth of labor productivity of workers engaged in the operation of obsolete equipment and, second, causes an additional need for work places. The importance of both these factors will intensify in connection with the forthcoming demographic situation (reduction in the rates of growth of the able-bodied population). On the basis of the decree of the CPSU Central Committee and the USSR Council of Ministers it is necessary to intensify the policy of utilization of capital investments for the technical renovation of fixed capital, which presupposes the establishment of scientifically substantiated optimum standard periods of renovation and stimulation of their fulfillment. It is important to attain a significant rise in the percent of withdrawal of obsolete machines and to ever more utilize major repairs for a qualitative renovation of fixed capital.

The fact that often the mastering of new equipment is accompanied by a considerable temporary lowering of indicators of economic accountability is a restrictive aspect in the development and introduction of new equipment highly efficient for the national economy into production. Therefore, in a number of cases preference is given to the selection of equipment with a small national economic effect, but whose mastering does not have such a negative effect on the indicators of economic accountability. According to the data of the Institute of Economics of the USSR Academy of Sciences, on the average, throughout industry only approximately one-half of the high initial expenditures of the period of mastering of new equipment are compensated from the appropriate funds. Up to now in a significant majority of cases the mastering of new equipment has resulted in a lowered profit or loss. According to the available calculations, in 1975-1978, on the average, in machine building ministries articles from the 4th or 5th to the 11th or 12th years of output had the greatest profitability.

The low level of effect of new equipment during the first years limits the increase in wholesale surcharges for the quality of output (the amount of a surcharge depends on the extent of the effect). A negligible extent of the effect of new equipment is also due to the fact that many of its types do not meet the requirements of the highest quality category. In a number of cases, owing to the excessive profitability of this output, surcharges are not set. All this leads to the fact that the effect of surcharges on profit and incentive funds throughout industry, according to the data of the All-Union Scientific Research Institute of Standardization, is still negligible⁹ (although it is considerable in a number of individual enterprises). On the basis of the implementation of the decree of the CPSU Central Committee and the USSR Council of Ministers it will be necessary, overcoming these tendencies, to greatly increase the economic role of the surcharge for quality.

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A transition to economic conditions that ensure right from the beginning the mastering of the output of new equipment a preferential economically accountable advantage for its manufacturer and from the beginning of introduction, for the consumer enterprise (of course, with good work and observance of standards by both) will play an important role. In a number of trends the decree opens up prospects for an increase in the economically accountable material interest of enterprises and associations in the mastering of highly efficient, new equipment. Therefore, it is important to provide the appropriate conditions for the implementation of the adopted decisions.

First of all, it is necessary to implement measures for lowering the costs and periods of mastering and introduction of new equipment, which are now (on the average) excessive. With due regard for this lowering progressive standards of costs and periods of mastering and introduction of equipment by years and appropriate trends, standards differentiated according to types of articles, should be developed. This involves standards of labor, material and capital intensiveness and production costs of articles, the series nature of output of new products, the time of mastering of industrial processes, attainment of the entire set of planned technical and economic indicators and formation and utilization of incentive funds in connection with the mastering and introduction of new equipment. When the progressive standards of mastering are fulfilled and overfulfilled, incentives should be increased and, when they are underfulfilled, lowered.

At the stage of mastering and introduction the planning indicators of the volumes of output and profit should meet both the requirements of efficiency of work (on the basis of progressive standards) and of the real characteristics and actual capabilities of these stages. A differentiated approach, on the one hand, to the process of mastering new equipment and, on the other, to the distribution of previously mastered equipment is needed in order to ensure a sufficient economically accountable advantage of the new equipment highly efficient for the national economy. This differentiated approach, in particular to the assignments for the volume of output, is envisaged in the decree of the CPSU Central Committee and the USSR Council of Ministers (paragraph 11). It is important to ensure a full coverage for additional expenditures, when such expenditures require compensation, according to progressive standards, including for wages, when incentive funds are lowered. As we assume, the entire set of measures for the attainment of an economically accountable advantage of the output of new equipment should be also extended to the stage of application (introduction) of equipment (with due regard for the specific nature of this stage).

Process of Realization of the National Economic Effect in Economically Accountable Activity

As the transition from one unit of the scientific and production cycle to another occurs, there is a change in the forms of the national economic effect of new equipment--from the projected to the planned and, finally,

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to the actual. This is a single process with significant characteristics at its various stages. The importance of managing this process, a single system of projected, planned and actual effects, is now rising sharply. The decree of the CPSU Central Committee and the USSR Council of Ministers pays special attention to the national economic effect of new equipment, including the planned "economic effect from the implementation of scientific and technical measures" among the planned indicators and assigning an important role to the total economic effect actually obtained in the national economy from the utilization of scientific and technological achievements. Depending on the actual effect incentives are set for new equipment. It should also be noted that the reflection of the national economic effect in planned indicators, norms and standards and in their fulfillment is one of the basic principles of the Methods for Determining the Efficiency of New Equipment, that is, it appears as an object of management of economic activity.

In practice, it is important for the socialist society to manage the process of increase in the efficiency of new equipment, to know what effect is actually obtained and to control and stimulate this practical result, not limiting itself only to estimated data. Socialist property and the objective forms of its organization predetermine the supremacy of national economic interests and, at the same time, the need and possibility for their realization through an economically accountable system of reproduction at enterprises (associations). National economic interests, the supreme goal of socialist production and conformity to the plan fully extend to all the levels of the socialist economy, entirely encompass the economically accountable activity of enterprises (associations) and form its basis. Therefore, the national social and economic effect ensuring and embodying public interests and the satisfaction of the material and spiritual needs of society with minimum expenditures not only does not oppose the system of economic accountability, but is realized through it.

The national economic effect is a criterion for the selection of new equipment and its inclusion in production plans so that in the final analysis this effect may be expressed in an improvement in the quantitative and qualitative indicators of economically accountable enterprises. The national economic effect does not at all conclude its role at the stage of selection of the best variant of new equipment. It is embodied in the real, actually obtained results of economically accountable activity. Owing to this, in accordance with the nature of the socialist economy the need and possibility for directing this activity toward public interests are realized. Thus, the national economic effect, assuming the form of an economically accountable effect in indicators of economic accountability at the stage of realization, by no means loses its essence. The economically accountable effect does not represent an isolated and different-type category with regard to the national economic effect, a form of which it is.

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The economically accountable effect reflects the organic unity of both aspects of the national economic effect, that is, the growth of the social and economic result and the saving of expenditures in terms of this increased result. The economically accountable effect reflects and realizes the same standards of expenditures, periods and results connected with the development and application of new equipment on the basis of the calculation of which the national economic effect is formed. Reflecting the national economic saving, the economically accountable effect is built on a reduction in the production costs and labor, material and capital intensiveness of articles and in specific capital expenditures. First of all, the "coming into effect" at the stage of realization of the national economic effect in the economically accountable effect of such categories as gross and net profit is connected with this saving. Economic accountability is not reduced to the saving of expenditures and profit. It is objectively directed toward meeting the needs of society and toward the supreme goal of socialist production. The profit and net profit of socialist enterprises themselves are organically connected with the entire set of indicators of social and economic efficiency and of the level of satisfaction of society's needs and directly depend on the specific saving of expenditures, on the mass output of articles and on the quality of output.

Thus, the economically accountable effect as a form of the national economic effect also has a specific aspect including the indicators of the volume, structure and quality of output and services. It reflects the expenditures and results of improvement in working conditions and of the protection of the natural environment and the unity of social and economic factors. In their nature the indicators of economic accountability of the saving of expenditures must be connected with the indicators of social and economic results, with the planned assignments for production and deliveries in the products list and with the actual record of their fulfillment. The calculations of the same indicators in a more tentative consolidated form are made during the determination of the national economic effect at the drafting stage (volumes of production and the scale of utilization of given output in the basic spheres of consumption). In practice, expenditures and profit do not function at all outside the volume and structure results of production, because they are calculated in terms of a unit and bulk of output, operations, services and various social results (reduction in production costs of planned and manufactured output of a certain assortment and quality).

The national economic effect and its economically accountable form reflect national economic interests. At the same time, the economic accountability of socialist enterprises objectively specifies the combination of national economic interests as determining with the interests of enterprises, their operational economic independence, material responsibility and economically accountable concern in the results of their work. Economic accountability is realized in the self-support and profitability of enterprises and in providing incentives for collectives depending on economic results and on profit.

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Therefore, being a form of realization of the national economic effect, the economically accountable effect of an enterprise (association) also includes such a factor as the "economically accountable advantage" of given output (operation). The socialist economic system determines the objective need and possibility for the correspondence of this economically accountable advantage of enterprise work to national economic interests. However, there is no automatism here--often contradictions arise between the direction of the actually formed economically accountable incentives of an enterprise (association) and the interests of the national economy. For example, sometimes profit is formed not on the basis of the efficiency and saving of expenditures, improvement in the quality of production and increase in the scale of its output, but as a result of an overstatement of prices and an assortment that is "profitable," but does not meet public needs. There is a need for a direction in the planning, evaluations and stimulation of the economic activity of enterprises that would constantly direct economically accountable incentives toward national economic interests.

The fact that the economically accountable effect of new equipment, like the system of economic accountability as a whole, under specific economic conditions directly reflects the real movement of resources and the actual results obtained in the process is an important feature of the economically accountable effect of new equipment. Therefore, the economically accountable effect of new equipment appears both as planned (envisaging the attainment of really obtainable levels of indicators of economic accountability) and actual, whose goal is to ensure the maximum possible reliability of the record of obtained results. Only with such an approach to the economically accountable effect is it possible to organically combine the management of scientific and technical progress with the specific economically accountable activity of enterprises and associations.

The record of the obtained effect cannot be sufficiently reliable if it is not expressed in really existing economic values and in actually attained results of economic activity, including in profit. The formula of reduced expenditures, according to which the national economic effect is legitimately calculated at the preindustrial stage during the selection of new equipment, does not include profit, but it is a mandatory element in the economically accountable effect at the stage of the output and application of this equipment. The planning of the effect of new equipment and the record of its actual realization reflect the real processes of the technical renovation of production and fixed capital. Therefore, at this stage new equipment should be compared with actually replaced equipment. Next, at the stage of selection of equipment the national economic effect is calculated for the sphere of consumption, which is quite valid. However, at the economically accountable stage it is necessary to reflect in the effect its distribution between the consumers and producers of new equipment--both actually participated in its creation and on this basis they have economically accountable results. Therefore, the economically accountable effect is calculated separately for the manufacturers and consumers of new equipment.

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Ignoring the indicated circumstances and characteristics of the stages of formation and realization of the national economic effect and confusing the tasks of the selection of new equipment and its functioning under the specific conditions of economically accountable activity would lead to the separation of this effect from the real processes of management and would deprive the record of the obtained effect of its reliability.¹⁰

The problem of the nature of actual effect is especially significant for the management of scientific and technical progress and for an improvement in the efficiency and quality of new equipment. The insufficient reliability of the record of the obtained effect and its separation from real economic values sharply lower the importance of the planned effect and worsen the conditions of planning of new equipment. A feedback from the reliability of the record of the actual effect to the planned and projected effects intensifies their role, which makes it possible to greatly raise the qualitative level of determination of the planned and projected effects and to greatly increase the responsibility for their substantiation. The responsibility of consumers and manufacturers of new equipment for a real attainment of the effect and its calculation will greatly increase if the record of the actual effect is made in the obtained economically accountable values.

From the essence of the economically accountable actual and planned effect from new equipment it follows that it should approximately reflect (in actually obtained values) the national economic effect calculated for the sphere of consumption according to the formula of reduced expenditures. This involves the following reflection: first, the saving of production costs ($C_1 - C_2$) and, second, subtraction from this saving of additional capital investments for new equipment (ΔK), which produced this saving, reduced to the annual scale through multiplication by such an important social standard as the standard coefficient of efficiency of capital investments (E_H). Without a subtraction of the expenditures on additional capital investments (in the formula of reduced expenditures this is $E_H \Delta K$) from the saving of current expenditures (forming gross profit) the calculation of the national economic effect of new equipment would be insufficient, that is, distorted. Under the specific conditions of economically accountable activity this subtraction $E_H \Delta K$ is reflected in the form of deductions to the state from the gross profit obtained from technical measures, that is, payments in a certain percent of the additional capital investments in new equipment. This means the transformation of gross profit into net profit as the final, actually obtained economic effect from new equipment.

We have in mind net profit separately for the manufacturer and consumer obtained from the realization of scientific and technological achievements as a result of a decrease in expenditures (in terms of a social and economic result) and improvement in the quality of output (through prices and surcharges). The bulk of produced new equipment is calculated for the manufacturer and the volume of output based on this equipment, for the

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consumer enterprise. Thus, in our opinion, net profit is an economically accountable form, which approximately reflects the national economic effect calculated according to the formula of reduced expenditures. This is due to the following objective factors.

1) The category of net profit represents the real result of the process of distribution of the total national economic effect among all three subjects--consumers of new equipment, its manufacturers and society at large (state). There is a distribution of this effect between manufacturers and consumers through the wholesale price of equipment (including the surcharge for the manufacturer) and next, the state receives from manufacturers and consumers part of the profit divided between manufacturers and consumers through a system of payments based on its standard distribution.

2) Payments from gross profit approximately (but in actually existing amounts) reflect E_{HAK} in the formula of reduced expenditures. These annual payments expressed in percent of the additional capital investments on technical measures are represented by the payment for capital and for credit, payments of a rent nature and as compensation for the damage done to the natural environment and so forth. All of them are connected with technical measures.

3) Deductions (subtractions) from gross profit in large measure "purify" it from the effect of factors not connected with the saving of expenditures and with an improvement in the quality and increase in the scale of production, that is, from unsubstantiated profitability (subtractions from profit for excessive profitability will be increased, according to the decree, which will increase the interest in a rise in the efficiency of new equipment).

Thus, net profit in combination with the indicators of the social and economic result of production and of the application of new equipment (which was discussed above) retains the objective foundations of the national economic effect that have already been laid down during the selection of new equipment. At the same time, net profit also embodies economically accountable interests to the greatest degree, because it represents the part of gross profit that remains at the disposal of enterprises (associations). It is comparatively simple to record and plan the economically accountable effect in the form of net profit as a real value (forms 2-HT and 10-HT with the appropriate modifications have a sufficient basis for this). There is a need for some additional measures for improving the primary record (subaccount and chart of articles) on the basis of the experience of a number of ministries, which has proved its value. In our opinion, between the determination of the national economic projected effect for the selection of new equipment and its realization in an economically accountable form--net profit--there should be an intermediary link in the form of calculated planning of the national economic effect in reduced expenditures with a partial consideration of

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the specific conditions of management. In such a calculation of the effect equipment slated for replacement should be taken as the basis for comparison. The effect is calculated for the planned period and all standards, volume and structure indicators of production and the scale of basic spheres of application are refined. Planning indicators include wholesale prices and surcharges. After that there is a transition to the economically accountable form of the planned effect in the form of assignments in indicators of economic accountability and a record of the actual economically accountable effect is made.

For analytical purposes (conditionally) the obtained effect should also be calculated according to reduced expenditures. Of importance is a comparative analytical calculation of the difference between the amount of profit and net profit, which during the calculated period (period of output and service of new equipment) would be obtained if previous equipment were not replaced. At the same time, as we assume, price reductions as a result of the obsolescence of previous equipment should also be taken into account (in accordance with the decree of the CPSU Central Committee and the USSR Council of Ministers these reductions will reach 50 to 100 percent of the profit). Such a calculation can be constructed on previously established standard periods of output and service of replaced equipment.

The transition from the calculated national economic effect expressed in the difference in the reduced expenditures of base and new equipment to the planned and actual economically accountable effect expressed in profit and net profit is based primarily on two factors: standards of expenditures and wholesale price. The standards of the saving of expenditures (in the final calculation of the growth of combined labor productivity) included during the calculation of the national economic effect in reduced expenditures serve as a connecting link with the economically accountable effect, because profit and net profit are constructed on the same standards, but in their real execution. The wholesale price, being the initial factor for the economically accountable effect, reflects the national economic effect (primarily through the difference between its upper and lower limits) and plays the role of a tool in the distribution of the sum of this effect between the manufacturer and consumer in the form of the profit of both of them.

The economically accountable effect of new equipment (both planned and actual) is calculated totally (each of them separately) for an enterprise (association) as a whole for all technical measures on the basis of the fact that an enterprise acts as a producer and consumer simultaneously. On a sectorwide scale the effect can be expressed in the impact of scientific and technical progress on an increase in net output and on the national economic level, on an increase in the national income.

Scientific and practical solutions of the problems of improving the mechanism of management of the efficiency of scientific and technical progress. will serve as one of the necessary factors for a successful solution of the major tasks of the social and economic development of our country.

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FOOTNOTES

1. See A. Glichev and Ya. Kotlikov, "Stimulation of Improvement in the Quality of Output" (VOPROSY EKONOMIKI, No 12, 1979, p 39). It states that in 1978 the proportion of new certified industrial articles included in the highest quality category comprised approximately one-fifth of the new types of industrial products (although this proportion is rising).
2. At the same time, we have in mind a gradual increase in the proportion of new equipment surpassing in quality and efficiency the best domestic and world models.
3. Often two different factors "live well together" in the practice of planning and design work: On the one hand, standards obviously insufficiently high, as compared with the actual possibilities for the utilization of the latest scientific and technological achievements, are included in a plan and, on the other, even these lowered indicators are not supported and insufficiently substantiated with the appropriate calculations.
4. The problem of a gradual transition to such a system under which in individual cases the output of new equipment corresponding to the first quality category can occur only with a coordination with the system of the USSR All-Union State Standard (including its ramified network of local supervision bodies) should be worked out. In connection with this registration of technical assignments, indicating either the correspondence of a plan to the conditions of the highest quality category, or to a coordinated permission for planning given equipment at the level of the first quality category is advisable.
5. It would be important to introduce sufficiently comprehensive and detailed data on the techniques of utilization of technical articles, conditions of their operation, performance and repair characteristics in planning documents and standards.
6. See the article by O. Korolev, director-general of the Krasnyy Proletariy Production Association, "Orientation Toward Final National Economic Results" (KOMMUNIST, No 8, 1978, p 49).
7. See, for example, VOPROSY EKONOMIKI, No 5, 1977, p 120. The correlation of the proportions of these groups remained approximately the same right up to 1978.
8. See "Narodnoye Khozyaystvo SSSR v 1978" [USSR National Economy in 1978], Statistical Yearbook, Izdatel'stvo Statistika, 1979, p 132.

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9. See the above-mentioned article by A. Glichev and Ya. Kotlikov (VOPROSY EKONOMIKI, No 12, 1979). In 1977 the additional profit from surcharges, on the average, comprised 4 percent of the price of a technical article and 10 percent of its total effect. With regard to the entire profit in industry in 1977 this additional profit from a surcharge was only approximately one-third of a percent and the proportion of surcharges in the formation of material incentive funds in a number of industrial ministries comprised one-third to one-half of a percent (in the Ministry of Electrical equipment Industry, 3.6 percent). Bonuses from the additional profit from surcharges in 14 industrial ministries comprised 1.7 percent of the total amount of bonuses per worker. The role of surcharges will now be increased considerably.
10. It should also be taken into account that, when the actual effects calculated according to the formula of reduced expenditures are summed up, a recalculation takes place (the same effect is calculated twice for the manufacturer and consumer), whereas, when economically accountable effects are summed up, each of them through profit is calculated once.
11. Naturally, scientific and technical progress should also be expressed in the growth of the surplus product, profit and net profit.

Incentives in Electrical Equipment Industry

Moscow VOPROSY EKONOMIKI in Russian No 1, Jan 80 pp 49-59

Article by V. Astaf'yev: "System of Incentives for New Equipment (Experience, Results and Prospects for Development)"

Text The practical experience of national economic sectors under the conditions of the economic reform and the economic experiments conducted in a number of industrial sectors have convincingly shown the need to improve planning methods and to increase the role of economic accountability and of economic levers and incentives. The decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Intensifying the Effect of the Economic Mechanism on Enhancing the Efficiency of Production and the Quality of Work" assigns an important place to the further improvement in economic methods of managing scientific and technical progress, whose acceleration was determined by the 25th CPSU Congress as a decisive condition for an increase in the efficiency and intensification of social production. An efficient management of the development of science and technology becomes one of the basic factors ensuring an organic connection between the achievements of the scientific and technical revolution and the advantages of the socialist economic system.

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New methods of planning, financing and economic stimulation of scientific and technical progress were worked out in the electrical equipment industry over a period of 10 years. Economic levers and incentives for an accelerated development of science and technology became widespread. There was a large reorganization of scientific institutions for the purpose of bringing science closer to production and increasing the efficiency of scientific and technical developments. The sector's practical experience under the new conditions shows the high efficiency of the implemented measures. The basic principles of economic methods of managing scientific and technical progress developed and approved in the electrical equipment industry were introduced in a number of machine building sectors and were reflected in the decree of the CPSU Central Committee and the USSR Council of Ministers on improving the economic mechanism.

Economic Mechanism of Management of Scientific and Technical Progress

The transition to the latest technology and production techniques based on fundamentally new scientific and technical solutions is the distinctive feature of the scientific and technical revolution at the present stage. Acceleration of scientific and technical progress should be inseparably connected with an increase in its efficiency on a national economic scale. In other words, the high level of economic efficiency of the development of science and new technology is the source of acceleration of both the progress of technology and of all economic development. Conversely, the low efficiency of scientific and technical progress hampers science and technology and the economic and social development of the national economy. Hence the need, first, to constantly improve the forms and methods of management of scientific and technical progress and, second, to refine an economically substantiated evaluation of the efficiency of scientific and technological development.

Improvement in the system of economic management of scientific and technical progress should be directed primarily toward a fuller satisfaction of social needs and toward ensuring the community of national economic, collective and personal interests during the production and consumption of new equipment. An economic evaluation of the activity of the producer and consumer of new advanced equipment should be based on a certain system of economic indicators reflecting the final national economic results. Total current and one-time expenditures in a single, organically connected "producer-consumer" chain are such indicators.

The national economic approach to the detection of the final result of scientific and technical progress requires a system management of the entire "science-technology-production-consumption" cycle. The system approach to the development of the economic mechanism of management of applied research, technical developments and the production and consumption of new equipment makes it possible to take into account both the general tendencies inherent in all the stages of this cycle and their specific features giving rise to the contradictions among these stages. The

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mastering of new articles disrupts the stability of production and temporarily lowers the indicators of the economically accountable activity of industrial enterprises, as a result of which contradictions between national economic and collective interests arise.

These contradictions can be resolved on the basis of an improvement in the economic mechanism based on the community of interests of all the participants in the "science-technology-production" cycle. The problem of a close interconnection between the rates of acceleration of scientific and technical progress and the rates of growth of its efficiency on a national economic scale can be solved successfully with the establishment of a criterion common for the economically accountable activity of both scientific organizations and enterprises. The results of activity of scientific organizations are manifested not only in the fulfillment of the volume of scientific research and experimental design work and the subject plan, but mainly in the final results attained in the production and operation of industrial output. Therefore, the economic effect of scientific and technical progress determined on the basis of reduced expenditures should become such a common criterion for economically accountable activity. The planning of economic effect from the implementation of scientific and technical measures is envisaged by the new decree in the five-year plans for the economic and social development of industrial ministries, associations and enterprises.

The components of economic effect in the form of reduction in the specific expenditures of all types of resources should be more fully reflected in the existing system of indicators of economic accountability of industrial enterprises--production volume, profit and labor productivity. At the same time, the mechanism of distribution of the economic effect must be built with due regard for the economic interest of all the participants in the development, mastering, production and application of new equipment. The unity of national economic and collective interests and the common criterion for an evaluation of the economically accountable activity of scientific organizations and enterprises will create the conditions for the orientation of scientific and technical progress toward social and economic efficiency. Therefore, overall nature is the basic methodological requirement ensuring an organic unity of all the elements within this specific system of management of scientific and technical progress and its interaction with the general system of management of the national economy.

Planning is the basic element in the economic mechanism of management of scientific and technical progress. The development of science and technology according to a unified plan is one of the most important advantages of the socialist system of management. The method of all-encompassing (continuous) planning on the basis of schedule-orders is an efficient method of planning science, technology and production ensuring their systematic and synchronous development.

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The experience in the application of this method in the electrical equipment industry shows that all-encompassing planning and execution of work according to a single network schedule ensure a significant increase in the economic effect, because, covering the entire "science-technology-production-consumption" cycle, they coordinate the volumes of work on the development and introduction of new equipment with the appropriate material and financial security, prompt development of production capacities and formation and utilization of material incentive funds.

The new approach to the planning of new equipment in the electrical equipment industry required a change in the system of financing measures for scientific and technical progress. The overall nature of the investigations, developments and production of new equipment predetermines the need for an appropriate financing of the volumes of work of the entire "science-technology-production" cycle from a single source. Following the experience of the electrical equipment industry, the single fund for the development of science and technology formed from profit has become such a source in a number of machine building sectors.

The financing of work from a single fund for the development of science and technology makes it possible to ensure a unity of the technical, planning and financial management of scientific and technical developments and to concentrate funds on important problems, on the successful solution of which the final results depend. Hence the need for an overall approach to the solution of problems of improving economic accountability and of bringing it into accord with other elements of the economic mechanism. For the further development of economic accountability in scientific organizations the new decree on improvement in planning envisages a transition to payment for fully completed and accepted operations with a simultaneous allotment of circulating capital to scientific research institutes and design offices. This will ensure a more efficient implementation of measures for saving monetary and labor resources and reducing the stages of investigation and incomplete studies in scientific research and experimental design work.

An important direction in the improvement in the planning and financing of scientific and technical progress is connected with the development of scientifically substantiated standards of economic indicators reflecting various aspects of the development of science and technology. The following are such long-effect economic standards introduced into the electrical equipment industry: the standard of deductions from profit into a single fund for the development of science and technology in percent of the planned volume of production of commodity output in comparable prices with due regard for the quality and effect of new types of articles; the standard of determination of the volume of expenditures on scientific research, experimental design and technological work in percent of the planned volume of production of commodity output in comparable prices with due regard for the quality and effect of new types of articles; the standard of determination of wages in scientific organizations

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in percent of the volume of expenditures on scientific research and experimental design work. On the basis of the decisions adopted in the decree the effect of these standards should be extended not only to the sector as a whole, but to all-Union industrial associations, enterprises and scientific organizations.

Price formation is an important unit of the system of economic management of scientific and technical progress in the sector. The wholesale price of the sector's output should envisage both a full reflection in prices of the economically substantiated expenditures on output and of the standard of profitability with regard to productive capital, on the one hand, and the consideration in them of the economic effect from the use of this output. As is well known, this share of the economic effect is included in the incentive surcharge.

A system of incentive wholesale surcharges for new output of the highest quality category was developed and introduced in the electrical equipment industry for the first time in the practice of price formation. During the 10 years of operation of the new system the amount of incentive surcharges increased by a factor of 4.5. In 1969 incentive surcharges in above-plan sales comprised only 9.7 percent and in 1978 they reached 30 percent; 0.9 and 3.6 percent in the balance profit and 22.1 and 90.4 percent in the above-plan profit. The measures envisaged by the decree on improvement in the economic mechanism, in the part of increase in the extent and period of effect of incentive surcharges, and the introduction of a system of reductions in wholesale prices of obsolete output are directed toward an accelerated introduction of scientific and technical innovations into production.

Material incentives for the development and mastering of new equipment occupy a special place in the system of economic management of scientific and technical progress. Increasing the interest of collectives of scientific organizations and enterprises in improving the efficiency of new equipment and in speeding up the periods of introduction of innovations into production is the general object of incentives for scientific and technical progress. The unity of interests of collectives in the entire "science-technology-production" chain can be ensured on the basis of the general principles and sources of formation of incentive funds for the development and introduction of new equipment. The decree defines the economic effect as such a criterion and profit obtained as a result of the introduction of innovations into production, as a source of formation of incentive funds.

Basic Results of Work Under the New Conditions

The results of work of the electrical equipment industry under the conditions of the examined system of economic incentives for new equipment indicate that it had a significant effect on an acceleration of the rates and increase in the economic efficiency of scientific and technical progress both in this sector and in sectors associated with it (power engineering, machine building and so forth). The overall approach to economic

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management of scientific and technical progress in the electrical equipment industry made it possible to increase the final results of both each element of the economic mechanism and of its system as a whole. The unity of the entire "science-technology-production" cycle was ensured, which made it possible to increase the efficiency of scientific and technological development. The basic data on the efficiency of scientific and technical progress in the sector during the 1969-1978 period are presented in the table.

| Indicators | 1978 in % of 1968 | Average Annual Rates of Increase (in %) |
|---|-------------------------|---|
| Commodity output | 216.0 | 8.0 |
| including of highest quality category | 10.4-fold | 26.4 |
| National economic effect from the production and utilization of new equipment | 531.0 | 18.2 |
| Single fund for the development of science and technology | 246.0 | 9.4 |
| Volume of scientific research and experimental design work | 270.0 | 10.5 |
| Economic effect: | | |
| per new article | 217.0 | 8.0 |
| per ruble of new articles | 366.0 | 13.8 |
| per ruble of a single fund | 215.0 | 8.0 |
| per ruble of scientific research and experimental design work | 241.0 | 7.2 |
| Incentive funds for new equipment | 292.0 | 11.3 |
| Incentive surcharges | 453.0 | 18.3 |

During the period of experimentation, as compared with the previous 5 years, the cycle of work from basic and applied research to the mastering of the first experimental batch of articles was shortened from two-thirds to one-half throughout the sector. In 1978, as compared with 1968, the national economic effect increased by a factor of 5.3 (in 1969-1978 its amount totaled about 8.0 billion rubles).

The specific efficiency of new articles increased considerably. For example, the economic effect per new article increased from 294,000 rubles in 1968 to 637,000 rubles in 1978, per ruble of the single fund for the development of science and technology, from 1 rubles 42 kopecks to 3 rubles 06 kopeckes and per ruble of scientific research and experimental design work, from 1 ruble 15 kopecks to 2 rubles 77 kopecks respectively. The proportion of the output of the highest quality category in the volume of output subject to certification increased from 12.2 to 58.9 percent during that period and of the first and second category was lowered from 60 to 42.5 percent and from 27.8 to 1.6 percent respectively.

The overall system of economic management of scientific and technical progress in the sector built on a single criterion of the efficiency of

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new equipment makes it possible to determine the trends and results of the technical policy in the electrical equipment industry, which is the technical base for the electrification of the national economy. As is well known, the level of development of this sector largely determines not only the scale of production of electric power, but also the possibility for its utilization in a large number of production processes and in homes.

Highly efficient electrical engineering articles were developed and introduced during a short period. A set of high-voltage and transformer electrical equipment of a voltage of 1,150 kw and hydrogenerators of a capacity of 640 Mw for the Sayano-Shushenskaya GES were developed for the needs of power engineering. A single series of turbogenerators of a capacity of up to 800 Mw makes it possible to increase the output of electric power by raising the efficiency by 0.1 percent and to prolong the periods between major repairs to 5 years. The introduction of elegas metal-clad switchgear reduces material intensiveness by a factor of 1.7, as compared with traditional equipment, increases the period between repairs to 10 years and greatly decreases the size of the service personnel. The set of electrical equipment for the transfer of mines with steep seams from pneumatic to electric power doubles or triples the productivity of mining machines and mechanisms.

The greatest effect is ensured as a result of the development of equipment operating on the basis of new principles--transformers on the basis of power semiconductor rectifiers, metal units with the use of standardized block control systems and light sources based on new principles of gas discharge and direct transformation of chemical energy into electric energy. Extensive work has been done on increasing the unit capacity, voltages and currents of electric machines and apparatus and on developing new series with improved technical and economic parameters--turbogenerators, electric locomotives, high-voltage equipment and a new series of asynchronous motors for general industrial purposes. The efficiency of production largely depends on the service life and reliability of operation of electrical engineering equipment. An increase in the reliability of equipment operation attained in the sector makes it possible not only to save on the expenditures on repairs or disconnection of electric transmission lines, but also to greatly lower the expenditures on reserving electrical equipment in case of a breakdown in electric supply systems.

Investigations in the sector made it possible to outline progressive trends in the development of science and technology for the immediate and long-term periods. It is primarily a matter of utilizing the economic effect of new equipment as the basic indicator on which the economic mechanism of management of scientific and technical progress is based. At the same time, the economic experiment in the electrical engineering industry attests to the insufficient connection between the indicators and results of scientific and technical progress and the indicators of

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the economically accountable activity of industrial enterprises and to the need to increase their economic interest in mastering the production of highly efficient, new articles.

National Economic and Economically Accountable Effects of New Equipment

The decree on improving planning calls for the establishment of a new indicator--economic effect from the implementation of scientific and technical measures. The methods of calculations of the economic effect of new equipment are specified in the Methods (Basic Principles) of Determination of the Economic Efficiency of Utilization of New Equipment in the National Economy. The task is to use these unified methodological principles of determination of the economic efficiency of new equipment in practice for planning and recording the economic effect and for reflecting it in the standards and indicators of economically accountable activity of industrial enterprises and sectors (production costs, profit, labor productivity, profitability, material intensiveness and so forth).

In the electrical equipment industry some experience has been accumulated in the planning and recording of the economic effect of new equipment. In annual plans the total economic effect is approved for every enterprise and all-Union production association--from measures in the area of improvement in technology, techniques, organization and management of production--that is, from a rise in the organizational and technical level of production, and from measures in the area of introduction of new types of products of the highest quality category into production--from the production and utilization of new articles in the national economy.

The economic effect from the introduction of measures for raising the organizational and technical level of production is calculated at two stages. A preliminary calculation of the annual economic effect is performed at the first stage on the basis of planned data. It serves to coordinate the efficiency of measures for technical progress during the planning of the indicators for labor, profit, profitability and production costs and to determine the planned deductions into incentive funds for the development and introduction of new equipment. At the second stage a calculation is performed after the introduction of measures based on the factual data formulated by the document of introduction. This calculation serves as the basis for reflecting the actual results of measures in the indicators of economic accountability of the work of enterprises and for the actual deductions of the capital of the fund for incentives for new equipment.

A record card is opened for each of the measures accepted for introduction. All the elements in the full production costs of output and capital investments (according to the plan and actually after the introduction) are stated in it. To coordinate the planned and actual results of measures with the indicators of economic accountability, data on shop

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production costs (with the deduction of depreciation and other shop expenditures) and on the number of workers calculated for the planned and actual volume of production are presented in the card. At the same time, economic indicators (production costs and the number of workers) are determined during the first calendar year of introduction of the entire volume of production planned or actually obtained and during the second, for the increase in the volume of production. A measure is considered introduced only from the moment of change in the material and labor norms of articles, for the improvement in which this measure is implemented. This gives the right to sign the document on the introduction of the measure and calculation of the funds for incentives for its introduction.

Thus, the annual economic effect from the implementation of measures for raising the organizational and technical level of production serves as the technical and economic substantiation for the selection of their best variants, for the reflection of the effect in the norms and indicators of economic accountability of the work of enterprises, all-Union production associations and the sector as a whole and for the determination of the amount of the fund for incentives for the development and introduction of new equipment. The additional capital investments necessary for the introduction of measures are coordinated with the plan for the expenditure of capital from the single fund for the development of science and technology and the production development fund with due regard for the plan for state capital investments, capital for major repairs and short- and long-term bank credits.

When the economic effect from the implementation of measures for raising the organizational and technical level of production is calculated, the technical and economic evaluation of the results of their introduction represents the greatest complexity, which is due to the imperfection of the standard base, lack of prices of the introduced materials and equipment and so forth. Furthermore, every enterprise introduces hundreds of different measures every year and, when their effect is calculated, often methodological errors are made. All this requires the maximum formalization and typification of measures and data for the calculation of their effect.

To further improve the quality of calculations of the economic effect and to lower the expenditures of labor on their performance and check, standards of the components of the economic effect on the basis of typification of measures, as well as an algorithm of calculations and programs for their execution on computers, are developed in the electrical engineering industry. The testing of programs after the examples of calculations of the economic effect from the introduction of new industrial processes in the Zaporozhtransformator Production Association has shown that the time of performance of one calculation with due regard for the collection of initial data, completion of the appropriate tables and so forth is shortened to two-fifths or to one-third. The forms, algorithms

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and programs for calculations of the effect on computers can be used by any machine building enterprise. There is a search for methods of mechanizing the calculations of the planned amount of deductions into the funds for incentives for the development and introduction of new equipment, as well as for forms of the plan for measures for improving the organizational and technical level of production.

Great methodological and practical difficulties occur during the coordination of the national economic and economically accountable effects from the production and utilization of new types of products. In the sphere of production of a new article the economically accountable effect is determined by the same methods as for measures for raising the organizational and technical level of production. Therefore, the consolidated economically accountable effect of production from the output and utilization of new equipment can be expressed as the difference between the increase of profit from all measures and capital investments multiplied by the standard coefficient of efficiency (0.15).

In the sphere of application of new articles, as is well known, their manufacturer determines the economic effect and coordinates it with the consumer. The economically accountable effect, reduction in production costs (increase in profit) and saving of capital investments from the utilization of new articles for the consumer can be determined by the manufacturer and, methodologically, this problem has been solved. At the same time, the manufacturer cannot present these data to planning bodies in terms of all consumers for taking them into account in the economically accountable planned indicators of work of the appropriate sectors consuming this new output, because not all consumers are known to him during the elaboration of the plan. Furthermore, the time lag between the delivery and utilization of new output existing for the consumer prevents the determination of these indicators for the appropriate calendar period. Therefore, in our opinion, the economically accountable effect from the application of new articles should be calculated and recorded only by the consumer in his indicators of economic accountability.

Thus, in the sphere of utilization of new equipment it is necessary to determine the consolidated economically accountable effect of production and to coordinate it with the indicators of economic accountability of both the implementation of measures for raising the organizational and technical level of production and the production of new articles. The economic effect from the production of new types of products and their utilization in the national economy should be intended for a technical and economic substantiation of the selection of the optimal variants of development and introduction of new (refined) articles with improved qualitative characteristics (rise in productivity, increase in durability, reduction in operating costs and saving of accompanying capital investments). It should also be utilized for the development of optimal trends in the development of the entire "science-technology-production" cycle and made the object of planning, recording, analysis and control. The economically accountable effect in coordination with the indicators of economic accountability should be determined and planned by the consumer of new articles.

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Improvement in Economic Indicators

The decree of the CPSU Central Committee and the USSR Council of Ministers on improving planning also envisages a wide range of measures for refining planning, increasing the efficiency of capital investments and intensifying the role of economic accountability and of economic levers and incentives. Large-scale organizational and methodological work on improving the economic mechanism of management of the sector on the basis of the adopted decisions is carried out in the electrical equipment industry. Economic indicators, the basic trends in the further improvement of which result from the objective conditions of the development of productive forces and individual aspects of production relations, occupy an important place in the improvement in the economic mechanism and provision of an interconnection of the economic mechanism of management of scientific and technical progress with the overall system of planning and stimulating the sector's development. At the same time, the degree of correspondence of the system of indicators to the objective requirements of economic development depends on how promptly these requirements are studied and taken into account and how refined the mechanism of knowledge of the effect of objective economic laws is. The new economic indicators envisaged by the decree, that is, growth of net output and, in some sectors, of commodity output in comparable prices, fulfillment of the specific orders of consumers and long-effect standards, now meet such requirements. These indicators and standards reflect the real movement of physical assets and labor expenditures to a large measure.

For the purpose of accelerating the rates of scientific and technical progress and creating economic conditions ensuring the interest of collectives of enterprises in a constant improvement in equipment, a new economic indicator of the growth of the volume of commodity output in comparable prices with due regard for the quality and efficiency of the manufactured equipment will be tested in the electrical equipment industry on a sectorwide scale in 1980. This means that with the output of highly efficient products of the highest quality category the rates of growth of commodity output will be determined by converting the volume of commodity output of the previous year into a coefficient taking into account the efficiency of new output as compared with replaced output.

The proportion of the economic effect from the production and utilization of output during the planned period (\mathcal{E}_n) taken into account during a recalculation of the volume of commodity output of the previous year in comparable prices according to the following formula is established for every new article of the highest quality category:

$$\mathcal{E}_n = \mathcal{E} \times K \times B, \quad (1)$$

where \mathcal{E} is the economic effect from the production and utilization of a unit of a new article, K is the coefficient for the determination of the proportion of the economic effect differentiated by groups of articles and B is the number of articles subject to output during the planned period.

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To determine the volume of commodity output during the previous year with due regard for the efficiency of new output (O_{on}), this proportion of the economic effect is summed up for all new articles and the obtained amount is excluded from the volume of commodity output of the base year (O_6):

$$O_{\text{on}} = O_6 - \sum \mathcal{E}_n. \quad (2)$$

The rate of growth of the volume of commodity output during the planned year (O_{II}) in relation to the volume of commodity output during the previous year with due regard for the efficiency of new output (O_{on}) is determined according to the following formula:

$$I = \frac{O_{\text{II}}}{O_{\text{on}}} \cdot 100. \quad (3)$$

The rate of growth of the volume of commodity output with due regard for the effect will be established for the planned period in terms of quarters in a running total. The planned assignment for labor productivity growth and the standard of the wage fund are also determined on its basis. The indicators of the rate of growth of the volume of commodity output with due regard for the effect, labor productivity and proportion of the output of the highest quality category become the basic fund forming indicators. The indicator of the annual plan for the volume of sold output is planned by the ministry itself in coordination with the USSR Gosplan for an evaluation of the fulfillment by associations and enterprises of the obligations for the deliveries of output for production purposes and consumer goods in the products list (assortment) according to the concluded contracts and schedule-orders for the delivery of output for export.

In case of utilization in production of relatively cheaper materials and substitutes and of more productive methods of processing bringing about a reduction in the wholesale prices of finished output, or in case of output of cheaper, new products which in their technical and economic parameters and quality are equivalent or superior to the replaced products the wholesale prices of these products are set with due regard for the preservation of the amount of profit obtained from the sale of previous products. At the same time, to determine the volumes of production and labor productivity before the end of the five-year plan, wholesale prices adopted in the plan for the replaced products are used.

The economic effect from the implementation of scientific and technical measures for raising the level of production, improving labor organization and refining management becomes the basic economic indicator. Its use ensures the saving of material, labor and other expenditures within every industrial enterprise. Thus, the new economic indicators are directed toward ensuring high final results--the saving of national economic, not only internal, expenditures. Nonfulfillment of the plan for new output or a reduction in its efficiency lead to the nonfulfillment of all the

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basic indicators (reduction in the rates of growth of the volume of production and labor productivity, the planned wage fund and incentive funds). Economic conditions ensuring the interest of collectives of associations (enterprises) in lowering labor intensiveness and in replacing expensive raw materials, supplies and accessories with cheaper ones are created for them. All this makes it possible to strengthen the connection of the results of technical progress with the indicators of economic accountability of the work of industrial enterprises and to ensure the combination of collective interests with general state interests.

The introduction of long-effect economic standards into practice is an important element in the improvement in the planning system. They make it possible, on the one hand, to strengthen the centralized management of public production and, on the other, to increase the initiative and operative independence of production collectives. Reflecting certain aspects of the relations of production, distribution and consumption, these standards are an important factor in an increase in the efficiency of production within a specific economically accountable unit (enterprise, all-Union production association or sector).

The standards of the wage fund occupy an important place among economic norms and standards. The introduction of long-term standards will increase the dependence of wages on an increase in labor productivity. In the electrical equipment industry beginning from 1980 this standard will be established for every enterprise on the basis of the correlation between the growth of labor productivity and average wages and increase in the volume of production as a result of labor productivity growth so as to ensure a reduction in the specific expenditure of wages on the volume of output. It is calculated according to the following formula (in kopecks per ruble of commodity output):

$$H_{\phi_3} = \frac{\phi_6}{O_6} \times \frac{100 + 3}{100 + \Pi} \times 100, \quad (4)$$

where H_{ϕ_3} is the standard of determination of the wage fund (without payments from the material incentive fund) per unit of volume of commodity output during the planned period, kopecks; ϕ_6 is the expected or actual wage fund of the industrial and production personnel during the base year, thousand rubles; O_6 is the expected or actual volume of commodity output during the same year, thousand rubles; 3 is the planned increase in average wages, %; Π is the increase in labor productivity envisaged during the planned period, %.

The value 3 is calculated as follows: $3 = C \times \Pi$, where C is the increase in average wages per percent of labor productivity growth.

During the determination of the planned wage fund of the industrial and production personnel in annual plans a recalculation of the volume of commodity output in comparable prices of the preceding year on the basis of

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the coefficient of efficiency is taken into account. In case of deviation of the actual output of new products of the highest quality category from the planned one the planned wage fund of the industrial and production personnel is refined in a running total from the beginning of the year. Therefore, both the planned and actual amounts of the wage fund are made dependent on the number of new articles and the extent of the economic effect obtained from the use of these articles by the consumer.

The implementation of the measures for improving the economic mechanism adopted by the party and government will require large-scale organizational work on developing and explaining standard documents and on providing specific help in the mastering and introduction of the new methods of planning and economic incentives. In the electrical equipment industry key workers at industrial enterprises, associations and scientific organizations are already being trained, teaching aids are being developed and advanced practical experience is being widely popularized. The practical implementation of the set of measures for improving the economic mechanism will contribute to a further rise in the efficiency of production and quality of work.

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ECONOMIC POLICY, ORGANIZATION AND MANAGEMENT

IMPROVEMENT OF THE CAPITAL INVESTMENT YIELD SOUGHT

Moscow VOPROSY EKONOMIKI in Russian No 1, Jan 80 pp 106-117

[Article by V. Krasovskiy: "The Economic Problems of the Output-Capital Ratio"]

[Text] The years of the Soviet five-year plans have seen a continuous growth of the economic and scientific-technical power of the Soviet Union. Our country now possesses enormous economic potential. L. I. Brezhnev has said: "The plants and mines, the blast furnaces and machines, the instruments and latest automatic devices--everything that we call productive capital--constitute the enormous wealth of the people. But we must be capable of exploiting this wealth in truly effective fashion. Without efficient scientific organization of labor, without effective planning and good management, and without increased responsibility for all the workers--from the production commanders to the production performers--, this wealth will not yield the return we have a right to expect."¹

The CPSU Central Committee and USSR Council of Ministers decree on "Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" instructs us when planning investments to keep in mind the potentialities for increasing output production in the operating enterprises by the fullest and most intensive use of their productive capacities and fixed capital. The decree calls for allotment on a first-priority basis of the resources necessary for technical retooling and remodeling of the existing enterprises. For purposes of more accurate justification of the plans we are introducing special enterprise certificates which should, on the basis of engineering and economic calculations, specify the extent of utilization of the capital, its technical level, and the basic technical and economic indicators.

Intensification of Production and the Expanding Role of the Capital Yield Indicators

The intensification of production entails not only reduction of the input of living labor along with increase of its capital-labor ratio but at the same time also reduction of the capital-output ratio and the production

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material input. "The chief thing we should count on is increased production efficiency. To put it in simple terms, the essence of the problem is seeing to it that for every unit of input—labor, material and financial—we obtain a significant increase in the volume of production and national income. This ultimately means a stepping up of the productivity of national labor."²

Under the present-day conditions, particular importance attaches to evaluation of the effectiveness and extent of utilization of the already developed production potential and national wealth as well as mobilization of all the resources.

It was comparatively recently that the rates of economic growth were determined in a number of cases in terms of the norm of accumulation in national income and the effectiveness of each unit of this norm.³ Thus, with a norm of accumulation of 25 percent and an 0.4 percent effectiveness of each unit of the norm, it was not difficult to arrive at economic growth rates of 10 percent. However, it was also believed that the economic growth was contingent only on the increased accumulations or capital investments in the various sectors of the national economy. In such calculations, the basic significance now attaches to the indicators for the use of the capacities already developed, that is, the growth of the yield of the productive capital.

Academician T. Khachaturov calculated the dynamics of the capital-output ratio in the 1970-1977 period. In 1977 the capital-output ratio, in comparison with 1970, was 119.6 percent for the national economy, 117.9 percent for industry, 138.3 percent for agriculture, 104.2 percent for transport and communications, and 136.6 percent for construction.⁴

In other words, whereas in 1970 1.21 rubles of national product was produced per ruble of capital, in 1977 the capital yield declined to 1.01 rubles, a decrease of 20 kopecks. What is the "price" of this decrease on the scale of the national economy? At the December (1974) CPSU Central Committee plenum it was noted that every kopeck of reduction of yield per ruble of capital was equivalent to a loss of approximately 3 billion rubles. Consequently, in 1977 the reductions amounted to approximately 60 billion rubles or 72 percent of all the capital investments in the production sector.

According to Ye. Ivanov's figures, of the 200 billion rubles of growth of national income obtained in the Ninth Five-Year Plan as a result of increased labor productivity, about 100 billion rubles were used to compensate for the decline in the yield on capital.⁵

It is often noted that the increase in capital-output ratio and capital intensiveness is a natural phenomenon because it is recovered through the saving in the current production costs. However, the figures cited by Academician T. Khachaturov in the article which opens this discussion, refute this idea. According to his data, where in 1960 the period for

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recovery of capital investments in industry was 5.1 years, in 1975 it was 11.1 years and in 1977 the wholly intolerable period of 25 years, which was three times the permissible normative length for this period.⁶ Thus, the undesirable movement of the output-capital ratio that is observed is only with great difficulty made up by the effectiveness of other production factors.

The basic factors which determine the dynamics of the yield on capital comprise the changes in the sectorial structure of production and capital investments, the extent of utilization of the fixed capital of the existing enterprises, and the change in the value of a unit of production capacities newly put into operation. At present these factors also include the substantially growing ecological costs and important changes in the territorial distribution of production and capital construction.

The significance of each of these factors is not the same. Analysis shows that the effect on capital yield produced by structural changes in industry, particularly the growth of the relative share of the sectors with a low absolute level of capital yield,--this effect is small and has a tendency to diminish. Even a substantial change in the extractive industry of the country's eastern region, which is characterized by a higher level of capital-output ratio, is not a dominant factor because on the scale of the investments of Siberia and the Far East they comprise not more than 15-16 percent of the total volume of investments. Moreover, the geographic changes in the distribution of industry is not by any means always the result of an increase in capital-output ratio because the coal industry is putting into operation more productive deposits with open-cut mining and the oil and gas industry is putting into operation special-purpose concentration resources, at least in the nearly inaccessible regions; in electric power engineering they are building very large stations on the powerful rivers with rocky banks and more favorable conditions for obtaining cheap energy with a saving of one-time costs, etc. In elucidating the economic problems connected with the development of Siberia, we took note of the favorable mining, geological and natural conditions in the East (more productive seams in the coal industry--rich ores in nonferrous metallurgy--better quality wood in the timber industry).⁷

Despite the fact that in a number of instances the ecological costs are large and their share of the overall cost increase sometimes rises to 30 percent, they make a negligible impact on the overall growth of the capital-output ratio (the proportion does not exceed 10-11 percent).⁸

On the basis of the indicators for both the shift system and the intrashift equipment load as well as many technical and economic indicators, the level of the utilization of the existing capacities is insufficient but in the dynamics it is not subject to significant changes of an unfavorable kind and therefore cannot account for the undesirable movement of the output-capital ratio.

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The chief reason for the decline of the output-capital ratio in industry and agriculture is the slow growth of labor productivity despite the continuous large increases of fixed capital. Also, the growth of the capital-labor ratio is exceeding the increase of labor productivity. Increasing at the same time is the cost of a unit of new capacities and the unit cost of the nonproduction installations. It is no coincidence that reduction of the cost per unit capacity of the production apparatus is considered a paramount task in the realm of reproduction of fixed capital. "The most important requirement in the development of new designs for machines, instruments and apparatuses," according to "The Basic Directions of the Development of the USSR National Economy in the 1976-1980 Period," "should be the achievement of maximum national economic effectiveness with a reduction in the cost per unit of capacity."

On the face of it, the industry wholesale price indexes applied by our statistics do not confirm the unfavorable movement of the cost of the means of production in comparison with the other sectors of industry. Thus, in 1978 the overall index of wholesale prices (1948 = 100 percent) was 63 percent for all of industry, 127 percent in the fuel industry, 113 percent in the timber and woodworking industry, and 80 percent in the electrical engineering industry; in the building materials industry, however, it was on a level of 67 percent and in machine building and metal working 33 percent.⁹ At the same time, there was a reduction, but not such a precipitous one, in the actual cost of construction and installation work, which in 1978 was equal to 98.4 percent¹⁰ (1970 = 100 percent). Thus, the sectors of the investment complex--machine building, the construction industry, and the building materials industry--are characterized, according to the TsSU [Central Statistical Administration] data, by a price and cost reduction which exceeds that of the raw material and fuel sectors, power engineering, and metallurgy. This data seems to us of doubtful validity. It may be suggested that the indexes for the movement of prices were compiled on a comparatively narrow basis which is not representative of the entire volume of capital investments of the comparable output group.

In practice the overwhelming portion of the new capital and capacities are not affected by a reduction in prices. On the other hand, the investment output is characterized by a substantial, and at times also an extreme, price or cost increase. This is exceptionally important because it leads directly to a substantial increase in the capital-output ratio for all the new and renovated enterprises and, consequently, to a reduction of the output-capital ratio.

Reduction of the Cost of Reproduction of Fixed Capital

The group of investment complex sectors exhibits the sharpest and steadiest deviation from the system of comparable prices adopted in the planning and in the operational work. However, it is the sectors of this complex which accumulate capital. In contemporary economics the focus of value changes is assumed to be primarily the prices for nonreproducible fuel and energy

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resources. At the same time, the most unregulated and uncontrolled price changes take place in the construction industry sector and the machine-building sector.

In the last 10 years the cost of construction and equipment--the most important components of fixed capital--has not declined but rather has significantly increased. Processing of the Stroybank [All-Union Bank for the Financing of Capital Investments] USSR-compiled data on the dynamics of estimate prices showed that prices rose 18 percent in 1970, 10.4 percent in 1971, 9.6 percent in 1972 and 13.6 percent in 1973. According to the approximate figures, a further rise of not less than 10 percent was observed in the Ninth Five-Year Plan estimates, that is, an increase amounting to about 50 billion rubles. A considerable increase in the estimated costs is being observed in the 10th Five-Year Plan. In a number of cases a large proportion of the allotted capital investments is being directed not to increasing the effect in the form of final product, but to compensating for the estimated cost increase.

According to the available data, the capital intensiveness per ton of steel was equal to 431.3 rubles in the 1965-1970 period and 586.1 rubles in the 1971-1975 period, or 135.9 percent of the Eighth Five-Year Plan figure. In the 1976-1980 period it equalled 760.5 rubles or 129.8 percent of the amount for the preceding five-year period. The overall rise in cost, as against the Eighth Five-Year Plan, was 176.3 percent, an increase of 146.8 and 126.1 percent respectively in capital intensiveness per ton of rolled stock.

A study of the dynamics of the estimated cost and the increased cost of new capital was made in the TsNIIchermet [Central Scientific Research Institute of Ferrous Metallurgy], which gathered extensive data for a number of large metallurgical plants. Thus, for purposes of evaluating the construction capital intensiveness for hot rolling sheet mills a comparison was made of the No. 1700 mills of the Karaganda Metallurgical Combine (put into operation in 1967) and the Metallurgical Plant imeni Il'ich (put into operation in 1960); also, a comparison of the No. 2000 mills of the Novolipetsk Metallurgical Plant (put into operation in 1970) and the Cherepovets Metallurgical Plant, the first section of which was turned over for operation in 1975. The comparison showed that the capital intensiveness per ton of yearly planned capacity for the strip mill of the plant imeni Il'ich was equal to 15.1 rubles and for approximately the same mill at the Karaganda combine it was 21.8 rubles, that is, 44 percent higher; correspondingly, the amount of technological equipment increased from 5.6 tons per 1,000 tons of planned capacity to 9,500 tons, or nearly 1.7-fold. The cost of planned capacity per ton at the Cherepovets plant was 11 percent higher than at the Novolipetsk plant, the cost of the technological equipment was 32 percent higher, and the cost of the materials handling equipment 43 percent higher.¹¹ For the converter shops the capital intensiveness per unit of production capacity was approximately 8-10 rubles per ton in the 1966-1970 period and rose to 14-16 rubles per ton in the 1971-1975 period. The price per megawatt for a turbine with a unit capacity of 800 megawatts is nearly double that for a turbine with a unit capacity of 300 megawatts.

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In many cases an attempt is made to attribute the increase in estimated cost to "the increase in capacity" of the installations under construction in comparison with the original drafts. Sometimes they also cite the need to take account of the new technical improvements. But after all, when there is a mass increase in the capacity of new installations, this would necessarily affect the growth of the stockpile of semifinished products for them. However, on the contrary, the planning organs have been taking note of the scant readiness of the available reserve of capacities.

We cannot agree with the arguments concerning the "inevitability" of the cost rises and the refinements in the estimated cost in the process of planning from the so-called technical and economic justification for the developed technical plan. Domestic and foreign experience indicates that skillful preparation of the planning documentation, careful examination by experts, and strict inspection of the finished products make it possible to sharply curtail the number of such correctives. It is also impossible to understand why the "refinements" are always geared for increasing the cost in the estimate and why they are made every year.

Sometimes they cite the utilization in the investment process of comparable and unchanging current prices for construction output or machine-building products. However, the so-called constant estimate prices are by no means prices for finished production output, that is, prices which take into account the capacity of the enterprises with a specific output production or prices for nonproduction installations which are fully ready for use; they function as prices for intermediate output, either individual types or larger-scale stages of the work. Changes can also be made in the technology of performance and the materials used. This specific character of the estimate prices explains the emergence of the potentiality for large-scale increase of the materials intensiveness of construction and replacement of cheap materials and technology with more expensive ones. It seems that the more expensive the materials used the easier it is to fulfill the plan for construction and installation work and to obtain a large wage fund and a large profit as well as a definite interest rate, which is applied to the cost of the construction and installation work. At the same time, the volume of the planning work was also determined by the scale of the construction and installation work stipulated in the plan; this prompted the planning workers to step up the cost of the installations being planned. All this at the same time created the conditions for the selection of materials-intensive solutions associated with the use of expensive designs, heavy machines, excessive-strength reserves, etc. Thus, the increase in prices for the output of the capital-accumulating industries also took place through orientation of the planning decisions for heavy and expensive materials, particularly for the widespread use of precast ferroconcrete. There was ultimately a considerable escalation of the capital intensiveness of the new installations and this led to an increase in the capital-output ratio for all the fixed production capital. Other factors, of course, contributed to the increase of capital-output ratio but the decisive role was played by the investment process, which is accompanied by a continuous escalation of prices. The

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incidental reductions in the prices for construction and installation work pertained largely to old or little-used products and consequently made no substantial impact on the overall index of investment prices.

Improving the Economic Mechanism and the Yield on Capital

A CPSU Central Committee and USSR Council of Ministers decree (July 1979) stipulates measures for accelerating the process of putting production capacities and installations into operation and increasing the effectiveness of the capital investments. As the decree indicated, evaluation of the operational activity of the construction and installation organizations will be based on the results of the completed assignments for putting production capacities and installations and commodity construction output into operation and for increasing labor productivity and profit. The decree ordered that there be completed in 1981 the introduction of settlements between the customers and the contractors for enterprises fully completed and turned over for operation and underway complexes, sections and projects prepared for the production of output and the rendering of services in accordance with the estimated value of the commodity output.

For purposes of a more accurate evaluation of the work of the construction organizations, the decree provides for the conduct of preparatory work for conversion in the 11th Five-Year Plan to the planning of labor productivity in the construction and installation organizations on the basis of a net output norm and planning of wages on the basis of a norm for a ruble of output. The use of this type of indicator will make it possible to correctly evaluate the true contribution of the construction organization to the creation of fixed capital.¹²

The state plans and the plans of the ministries and departments of the USSR and the Union republics should first of all take account of the potentialities for increasing output production in the existing enterprises by a fuller utilization of their production capacities. The next few years will see a substantial increase in their share of the costs for remodeling and technical retooling of the production potential already developed.

Within the framework of the decisions taken, additional requirements must be applied to the capital yield indicators. As a rule, this does not include the indicators which allow for repeat accounting of output and growth of intermediate production according to type of gross turnover or gross production. The accounting must be based on the yield of final product. The indicators for sale of output may be used but only if this output conforms to the contracts, that is, is based on the prescribed product assortment and output quality.

In the system of effectiveness indicators the yield on capital can only be determined on the basis of the result in the form of physical or final product expressed in value terms (but in comparable prices). Computation of the output-capital ratio on the basis of profit would make this indicator a

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measure of profitability and on the basis of net output an indicator of the overall effectiveness of the capital. As it is, the specific character of the indicator of yield on capital is expressly commensurate with the physical volume of the output and the value of the means of labor.

We know that Marx repeatedly used the relationship between the mass of output and the value of the machines in the context of technical progress and he established a governing principle with respect to reduction of the cost of machines with the growth of their capacity and productivity. He wrote: "Production of machines with the help of machines reduces their cost in relation to their dimensions and their performance." In his opinion, the ratio of the physical volume of production to the value of the means of labor becomes greater when we go over to machine technology. In the methods plan the output which is designated in the numerator of the fraction conveying the simplest formula of capital yield, $\frac{Q}{C}$, must, with all its modifications, reflect the physical volume of output, either in physical terms or in comparable prices which convey this physical volume with certain qualifications. As far as the nominator is concerned, fulfillment of this requirement is not mandatory. Assessment of the volume of fixed capital in comparable prices and moreover in prices of the year which was used for evaluation of the output makes the capital yield indicator a measure of the physical yield (for example, for the type of skimming of metal from one square meter of open-hearth furnace, where both the metal and the furnace bottom are described in physical parameters). Indicators of this kind are useful but they have no economic cogency. The economic indicator of yield on capital must expressly reflect the depreciation or appreciation of capital per physical unit of output. It follows from this that the volume of capital in the denominator of the fraction must be expressed in current prices which allow for the changes in these prices during the period being analyzed but eliminate the market changes in prices for materials and fuel being delivered.

Coming into focus is the question of how the amount of the capital is affected by price changes which increase the volume of this capital not because of its greater labor intensiveness or materials intensiveness but because of the purely value changes which take place outside of the capital-generating industries, such as, for example, the fuel industry, electric power engineering, metallurgy, and others. Such changes in the raw materials price handbook should perhaps be eliminated when the output-capital ratio is computed on the basis of the indexes adopted when the prices were reviewed.

The indicators for yield on capital are determined both on the higher levels of planning and management and on the level of the shops, departments, units [bloky] and centers of the enterprises.

In keeping with the new decisions aimed at intensifying the impact of the operational mechanism in enhancing the efficiency of production and the quality of the work, the capital-output ratio must gradually become not only one of the technical-economic parameters for the activity of the enterprises and associations but also the chief cost accounting indicator. In its current

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stage the process of reproduction of fixed capital makes it necessary to incorporate in the investment sector the delivery for operation of capital construction installations "under key," that is fully ready to produce output or render services. This kind of system for putting new installations into operation provides for a stable contract evaluation of the installations instead of the variable estimate value for them. This evaluation should also be the basis for the customer's appraisal of the completed capital work. In line with this, the capital-output ratio or its opposite output-capital ratio indicator will serve as an important measure of the price for a unit of production capacity. This latter should also be stipulated in the relevant contracts (as, for example, the price of large machines, transport means, residential houses and other investment output). Such prices become an important element of the estimate of the cost and profitability of output produced in the new enterprises and installations. The arbitrary change in these prices which takes place in present-day capital construction has an immediate adverse effect on the production costs incurred by the shops, sections and units of the new enterprises.

The consistent expansion of the cost accounting requirements placed on the final investment output must be reinforced by motivating the planners and contract construction organizations to maintain stable contract prices for the output of construction and machine building. Using the indicator of volume of construction and installation work for motivation led to increased use of heavy and expensive building materials; this, in turn, greatly increased the cost of the new fixed capital and reduced its output-capital ratio and its profitability.

In the past there was frequently advanced the idea of using the normative capital intensiveness and capital-output ratio in the capacity of prices for investment output. This even gave rise to the idea of establishing such price handbooks for some of the model structures and installations which are covered by the planning standards. The idea was to determine, first, the price of an actual model installation and, in addition, the cost of "harmonizing" this installation with a specific territory. We believe this kind of standardization of prices is a matter of great interest in both industrial and agricultural construction and also in the erection of many civil structures. Seemingly, even home construction combines would have handbooks of prices for model schools, polyclinics, hospitals, stores, etc. The fact that the idea of "investment price handbooks" did not proliferate in the past is due, we believe, to the characteristics of the operation of the previous economic mechanism, when they did not place the necessary emphasis on payment expressly for a fully completed project and when they had an intermediate inspection of the construction output at the various stages of the work or else payment for the achievement of partial results. Orientation in the direction of a gross indicator for volume of construction and installation work did not provide motivation for the use of investment price handbooks because they assumed payment for a fully completed installation. Now, on the other hand, there is evolving a favorable situation for widespread proliferation of this progressive undertaking.

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The problem of prices has still another aspect, one which is very important in relation to determination of the level and trend of the movement of the output-capital ratio. We refer to the fixing of prices for the means of production, prices which take into account their effect on the consumers and which incorporate a considerable part of this effect in the so-called limit price or the price at a permissible higher level. Because the forthcoming effect in consumption is generally a very rough guide and frequently not achieved in practice but is embodied in the price as a wholly real amount, the consumer's capital-output ratio increases and is by no means always made up by a reduction of the current costs in the subsequent operation of the new fixed capital. This method of price fixing, particularly for machine building output, has a significant effect on reduction of the yield on capital and apparently requires definite correctives.

Methods of Determining and Measuring Yield on Capital

The operational purpose of the capital yield indicators entails the selection of the most progressive and economical means of labor, which are characterized by a relative reduction in the cost of the production capacities. It also entails the determination of the load and degree of use of the fixed production capital already on hand.

It is consequently essential to take a critical view of the capital yield indicators, which cannot, by their very nature, serve as a reliable guidepost in analysis of the use and effectiveness of the production capital. We should first of all be aware of the doubtful value of such oversimplified gauges employed in the nonproduction sector as one school seat, one bed in the hospitals, one seat in the motion picture theaters, one seat in the dining-rooms, one study place in the VUZ's, one square meter of housing, etc. In transport indicators of this kind are one kilometer of railroad tracks or motor roads, one kilometer of canals or 100 meters of moorage and wharfs at the ports, etc. and in agriculture one cattle place, one hectare of cultivated areas, etc. The fallibility of such a selection of gauges lies in the fact that in dynamics the course of technical progress will entail the continuous growth of the extent to which these industries are equipped with instruments, computer equipment, apparatuses and machines. In transport the modern improved motor highways accommodate far more freight turnover and the high degree of machine equipment in the livestock breeding complexes makes possible a significant increase in the animal husbandry output. However, despite the growth of the fund of equipment, the "immobile," abstract physical gauge creates the impression of a continuously declining capital yield. But this impression is incorrect. The fact is the growth of the fund of equipment results in incomparably greater comfort in the nonproduction realm and greater potentialities for education, medical treatment, etc. In transport the increase in the fund of equipment means breakdown-free operation, reliability and speed of transport of the freight mass, etc.; in agriculture it will make it possible to obtain more output per hectare or per animal husbandry space.

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Thus, the poor choice of measures of capital yield disorient the planning and create a false picture of a general decline of the output-capital ratio.

Distortions of a similar kind are generated in comparing the current and the earlier funds without regard for the new social and ecological functions performed by the new funds. They provide not only new volumes of output but also additional social effects which are reflected in improvement of the conditions of labor, a sharp reduction in harmful discharges, better lighting and ventilation, reduced noise, etc. If we do not take into account the social consequences generated by the group of "social" funds and if we compare all the outlays only with the production of output, then we create the impression of a declining yield on capital even though this will be an erroneous conclusion. In the future, new fixed capital will to an ever greater degree be equipped with ecological and social installations and it is consequently wrong to artificially exclude them from the overall capital balance. In determining the results obtained we must without fail take account of the increasing social effects and not measure the output only against the entire quantity of new capital.

In computing the indicators for yield on capital we also need to improve the procedure for making the correct selection of a basis for comparison. This is particularly true of the evaluation of the capital in determining the comparative effectiveness of new construction and remodeling and also in comparing the economic indicators for the remodeled enterprise before and after remodeling. Serving as the basic indicators in all the comparisons of this type are the evaluations of the existing capital in previous years' prices which do not embody the subsequent revisions of the price handbooks for the output of machine building and construction. The evaluations of the existing capital are usually lower than the current prices for reproduction of it. Only in the years of revaluations and general inventories do the price levels catch up and become comparable. But the general inventories take place infrequently, approximately once every 10 years, and hence most of the comparisons of old and new capital are made in prices of a different level.

It can therefore be recommended that evaluation of the existing capital be made on the basis of the renewal cost, that is, the cost of reproducing it in terms of the current estimate and handbook prices. Another method of correcting this data is to calculate the cumulative cost of the capital repairs made in recent years, where payment was carried out in current prices, and to add these costs to the residual value of the capital. We must avoid investment decisions based on uncomparated data, which usually exaggerates the effectiveness of the old capital and artificially increases the size of the yield it generates.

There are specific features characterizing the output-capital ratios obtained in accomplishment of the work of maintaining the existing capacities and making the necessary capital repairs. Such forms of reproduction of capital usually do not exist in pure form. They are frequently combined with the

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modernization and renewal of the production and consequently, in many cases they retain the elements of not only simple but also expanded reproduction. Even in simple fixed capital reproduction based on cost, provision must be made for expanded reproduction based on capacity or on production of output of the same volume but improved quality.

These considerations may not always be applicable to the fixed capital of the mining sectors of industry, where new fixed capital must be introduced in order to maintain the existing production capacities and not to increase them. For example, in the coal industry, the transitory nature of the working sites requires the introduction of fixed capital even when there is a continuous extraction of coal. At the mines they work on mining operations to achieve passage to the lower levels, lengthening of the roadways, introduction of additional airways, etc. Also, much of the ongoing work is supplemented by new projects which do not, however, make for increased extraction. In cases like these the output-capital ratio indicator which is derived in the usual way for all of the old and new capital will continuously decline.

The same situation also obtains in timber operations and in other sectors of the extraction industry. The characteristic feature of the capital yield calculations in these industries can be the use of, not the full cost, but a residual one based on these mining operations, the aim being to reduce the recalculation of the operations and the lengthy time period required by those participating in production and working on extraction of all the reserves. We have observed that in the extraction industries the calculation of residual cost is facilitated when, as in the coal industry, for example, amortization of output is carried out at a tonnage rate in relation to the amount of the yearly extraction. Also, the greater the number of years this production has been in operation and the greater the volume of extraction it has generated, the less its residual cost.

In the computation of the indicators of yield on capital there may be cases where a considerable proportion of the new capital is earmarked, not for the increase of output production, but for reduction of labor intensiveness, curtailment of the input of manual labor, enhancement of the labor safety techniques, and solution of important social problems at the enterprises. It is necessary to determine the impact of these factors on the dynamics of the yield on capital and also to take into account the social effect being generated. A possible decline of the yield on capital under these circumstances should not be considered an impairment of the use of the fixed capital.

Determination of the output-capital ratio in reproduction of fixed capital should take into account the specific character of the various forms of reproduction: remodeling and technical retooling of the fixed capital currently in operation and maintenance of its capacity as well as that of the new construction. Present-day conditions require the focusing of a great deal of attention on renovation.

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The Extent of the Load and the Renewal of Existing Capital

The distribution and full utilization of the productive capital constitute the most important requirement for stepping up the output-capital ratio. Currently the most intensive load pertains to the sectors of transport and power engineering, which operate continuously and with extensive use of the railroads, the oil and gas pipe lines, the electrotransmission lines, and the electric power station capacities. Although in comparison with the other industries these sectors handle a large load, they nevertheless conceal considerable reserves. The industries which take on a greater degree of load are those with a continuous production process and multishift operation (the metallurgical and chemical industry, some sectors of light industry, and others). The poorest use of fixed capital is in the investment complex sectors, where one-shift operation predominates. The most difficult situation is the one in the agroindustrial complex, which is characterized by seasonal irregularity of operation and by forced idleness of the bulk of the equipment in the winter period. This group may include some types of transport and industry (river transport, peat mining, the aviation industry in part, and others).

The diversity of kinds and types of output and methods of organization of production dictated very diverse methods of calculation of production capacity and the use of this capacity. This hampers the use of uniform indicators which are capable of providing an integral evaluation of the use of the productive capital potential in the unified measuring instruments.

The economic studies at one time suggested comprehensive energy indicators based, not on the calculation of the operation of various machines and technological units, but on the readings on the devices recording the time of operation of the electric motors which serve this equipment. Ya. Kvasha gave the most convincing justification for this kind of methodology.¹⁴ This author correctly noted that there is a close relationship between the changes in the production capacity and the capacity of the motors which serve the working machines, apparatuses, transport mechanisms, etc. For study of the capital load he suggested the so-called capital capacity coefficient (the correlation between the fixed capital and the capacity of the motors). He calculated the possible and actual coefficients of capital load and he showed the existence of substantial potentialities for stepping up the use of the capital.

Such calculations were made comparatively recently at the Moscow plant imeni Vladimir Il'ich.¹⁵ According to V. Radin, the operating time for electric motors in our country has averaged 1,500 hours a year. According to Ya. Kvasha's figures, the number of hours of use of electric motors in the United States was 2,660 back in 1962.¹⁶ The established capacity of the motors is very great and it exceeds the capacity of our electric power stations. But the inadequate load of the motors is a basic characteristic of the capital load.

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An important reason for the decline in output-capital ratio is found in the slow rates of putting new enterprises into operation. The effect of losses resulting from the starting up of production on the level of yield on capital for the various sectors of industry is indicated by the following data: for electric power stations--2.4 percent, steel--1.2 percent, cement--1.4 percent, tractors--2.1 percent, turbines--2.6 percent, fertilizers--4 percent, etc.

In industry a substantial potentiality for stepping up the yield on fixed capital is punctual and regular renewal of the production apparatus. Accumulation of obsolete and outworn capital in the industries inhibits improvement of the economic indicators, entails large-scale labor resources, and requires exorbitant expenditures for repair, which is usually done on a low technical level. At the same time, technical retooling of the capital on hand and improvement of the technology give quick and effective results. Thus, in the building materials industry the introduction of a progressive method of heat treatment of polished glass has quadrupled the labor productivity, cut the cost of production in half, and increased the yield on capital by 46 percent. Sizable results are being obtained from stamping by blasting in electric beam welding and other modern innovations.

Substantial potentialities have been uncovered in improvement of the use of agricultural equipment, buildings, structures, and other fixed production capital. In a number of instances there is evidence of an irresponsible attitude toward the operation and maintenance of the fixed production capital.

In agriculture increased yield on capital is primarily the result of a fuller exploitation of the biological potential of the capacity of the agricultural crops and the productivity of the animals. Thus, bringing the yield on the sovkhozes and kolkhozes to the level obtained in the grade-testing sectors would enable us to increase the volume of farming output by not less than 30-35 percent. Increasing the production of mixed feed and eliminating the deficiency of albumen in the animal rations will make it possible to increase their productivity by a minimum of 25 percent.

The indicators for yield on capital must be reviewed in the plan for increasing labor productivity in the capital-generating industries. The national economy requires of the workers of the investment sectors that they produce output with minimum labor input per unit of useful product and per unit of capacity of the machines, units, technological lines, etc. At the same time, the workers of the construction industry are required to economize in costs for the components of buildings and structures while taking measures for reduction of the estimated cost. We must bear in mind that progressive and economical means of labor will promote further increase of labor productivity and production efficiency in all the national economy sectors which are concerned with renewal of capital.

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FOOTNOTES

1. L. I. Brezhnev, "Problems of the Management of the Economics of a Develo- ped Socialist Society." Politizdat, 1976, p. 561.
2. Ibid, p. 293.
3. See, for example, O. Lange, "An Introduction to Econometrics." Izdatel'stvo Progress, 1964, pp 229-230; M. Karetskiy, "An Outline of the Growth of the Socialist Economic System." Izdatel'stvo Progress, 1970, pp 27-28.
4. See T. S. Khachaturov, "The Effectiveness of Capital Investments." Izdatel'stvo Ekonomika, 1979, p. 210.
5. See Ye. A. Ivanov, "The Problems of Reproduction of Fixed Capital under Intensification of the National Economy (Methods and Practice of Determining the Effectiveness of Capital Investments)" No. 28, 1977, pp 6-8.
6. See T. S. Khachaturov, "Ways of Increasing the Effectiveness of Capital Investments" (VOPROSY EKONOMIKI No. 7, 1979, p 124).
7. See Academician A. Aganbegyan, "The Economic Problems of the Development of Siberia" (EKONOMIKA I MATEMATICHESKIYE METODY [Economics and Mathematical Methods], Vol 15, No 5, 1979, pp 843-844).
8. See P. A. Shirayev and V. A. Shtanskiy, "The Effectiveness of Capital Investments in Ferrous Metallurgy." Izdatel'stvo Metallurgiya, 1977, p 188.
9. See "The USSR National Economy in 1978." STATICHESKIY YEZHEGODNIK [The Statistical Yearbook]. Izdatel'stvo Statistika, 1979, p 139.
10. Ibid, p 360.
11. See P. A. Shirayev and V. A. Shtanskiy, "The Effectiveness of Capital Investments in Ferrous Metallurgy," pp 181-185.
12. See A. N. Kosygin "An Important Stage in Improvement of Economic Planning Management" (KOMMUNIST No. 12, 1979, p 24).
13. K. Marks and F. Engel's, "Works," Vol 23, p 401.
14. Ya. B. Kvasha. "Reserve Capacities." Izdatel'stvo Nauka, 1971, p 101.
15. See "The Potentialities of the Economics of Material Resources" (VOPROSY EKONOMIKI No. 7, 1979, pp 54-55).
16. See Ya. B. Kvasha, "Reserve Capacities," p 137.

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