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USSR Report

ECONOMIC AFFAIRS

(FOUO 12/80)

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USSR REPORT
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ECONOMIC POLICY, ORGANIZATION AND MANAGEMENT

USE OF ECONOMIC LEVERS, INCENTIVES DESCRIBED

Moscow VOPROSY EKONOMIKI in Russian No 5, May 80 pp 42-50

[Article by S. Osadchenko: "Experience in the Use of Economic Levers and Incentives"]

[Text] In the decree of the CPSU Central Committee and the USSR Council of Ministers "On improving the planning and intensifying the action of the economic mechanism on increasing the effectiveness of production and the quality of work" (1979) a system of measures is defined for further improvement of planning and management and bringing them into correspondence with the demands of developed socialism. Under today's conditions in order to strengthen cost accounting there is an increase in the significance of the system of quality sanctioned and valuation indicators, which describe an increase in the effectiveness of public production, improvement in the quality of work and insurance of full satisfaction of social demands, impelling the collectives of associations, enterprises and the sector as a whole to the achievement of high end results for the national economy.

Evaluation of the results of the economic activity of associations and enterprises, and also their economic incentives have been made dependent on fulfillment of the plans for delivery of output for production and technical purposes and consumer goods according to nomenclature (assortment) in the periods in accordance with the contracts concluded. A new procedure has been provided for approving the compulsory nomenclature for the establishment of direct economic relations and conclusion of contracts for the delivery of output, the fulfillment of which is possible with complete coordination of the production plans with the physical resources, that is, the balanced nature of them at the level of the primary unit. Thus, the indicator of delivery of output characterizes in full the degree of satisfaction of social needs regarding the volume and structure of production.

For the purpose of more economical expenditure of physical and labor resources it has been recognized necessary to introduce the indicator

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of net output (normative), which is aimed at increasing the effectiveness of production and improving the quality of the enterprise's work. It reflects the contribution of the labor collectives to the newly created product, eliminates interest in increasing the materials-intensiveness of production, and contributes to objective evaluation of the performance of the association (enterprise).

An interest in putting out more labor-intensive output has appeared at the enterprises with the introduction of the net output (normative) indicator. The work experience of the Ministry of Heavy Machine Building showed that in the case of deviation from the assigned nomenclature the enterprises should have produced output to replace what was not produced with the same proportion of labor outlays. In addition they tried to find reserves for increasing the yield of labor. Use of the net output indicator improved the ratio between growth in labor productivity and wages, and lowered the outlays per ruble of commodity output. Thus, during 1978 labor productivity increased by 5.5 percent, but the average wage increased by 2.5 percent. The wage expenditure taking into account payments from the material incentive fund per ruble of net output (normative) in 1978 was reduced by 2.6 percent in comparison with 1977. The relative saving of the wage fund in 1978 came to 2 million rubles.

Utilization of the indicator of net output (normative) affected a reduction of expenditures per ruble of volume of output. For instance, in 1978 the physical outlays per ruble of commodity output were reduced by 0.2 percent, and the outlays for purchased semi-manufactures were reduced by 0.4 percent.

The indicators for produced output in physical terms are being improved. In addition, the nomenclature to be approved in the five-year and especially in the annual plans will be expanded. Essential changes are taking place in the system of measurements of physical indicators of output in a number of sectors, which will make it possible to account for the effectiveness, quality and other consumption properties of output produced.

Provided by the new conditions of management is the establishment in the five-year and annual plans for associations, enterprises and ministries of systems of long-term norms: distribution of profit, outlays of wages per 1 ruble of output produced, deductions from profit into the economic incentive funds and the unified fund for development of science and technology. The use of economic norms will create the conditions for improving the end results of the economic activity of associations, enterprises and ministries with simultaneous growth in the profit contributions to the state budget. Such a system of indicators and norms is being used at the present time in the Ministry of Heavy Machine Building, the Ministry of Power Machine Building, the Ministry of Agricultural Machine Building, the Ministry of Instrument Building, and the Ministry of the Electrical Engineering Industry, and their many years of experience has made it possible to work out a number of positions regarding the development of cost accounting.

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In the decree it is intended on the basis of working out a five-year financial plan to establish not only the assignments for profit for the years of the five-year plan, but also to determine the absolute sums of payments to the budget and allocations from it, and to approve the long-term norms of deductions from profit to be at the disposal of the ministries, associations and enterprises.

The normative method of profit distribution has its own merits in comparison with the existing system, since it strengthens the action of the principles of cost accounting, creates the economic premises for introduction of the system of self-backing with financial resources, increases economic interest in mobilization of internal reserves, increases cost accounting responsibility for payment obligations to the state, and establishes a direct relation between the outlays for expanded reproduction and the results of current and long-term performance of a production facility.

In addition, it stimulates an increase in the effectiveness of production, since part of the above-plan profit is put at the disposal of the ministries, associations and enterprises with consideration of their contribution to the overall results of economic activity.

It is provided by the decree that when determining the norm it is necessary to reckon all the outlays for in-house needs: for financing reproduction (for capital investments for construction, expansion, modernization and mechanization of production), for upkeep of the management apparatus, kindergartens, preschool institutions, fees for loans, for formation of a unified fund for development of science and technology, economic incentive funds and other expenditures connected with development of production. Established by years of the five year plan, taking into account these outlays, are the norms of profit left at the disposal of the ministries, and the absolute sum of the profit going into the state budget is determined.

Worked out in order to increase the responsibility of the ministries was a cost accounting mechanism guaranteeing completeness of contributions to the budget from the profit in the sums envisaged for the given year, independent of the end results of financial-economic activity. This mechanism operates as follows. In the case of underfulfillment of the profit plan by the ministries, contributed to the budget is the sum of profit written in the plan. In the case of overfulfillment, part of it remains at the disposal of the ministries, and the other part is transferred to the budget. In this case, the greater the percentage of overfulfillment of the plan with respect to profit, the smaller the share of it left to the ministry. Such an economic lever forces the ministry, the association, or the enterprise to take on more stepped-up plans.

Cost accounting on the scale of the sector has increased control over the production and economic activity of production units, and has demanded a qualitatively new approach to organization of the management of associations, enterprises and organizations, and it has increased the interest of all units of production in achieving high economic indicators and in addition it has substantially increased their responsibility for fulfilling the state plan.

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The Ministry of Instrument Building, for instance, fulfilled the quota for the Ninth Five-Year Plan and is continuing to operate successfully in the Tenth Five-Year Plan. The growth in volume of production during 1976-1978 with a plan figure of 136.2 percent was 136.6 percent, for profit it was respectively 178 and 195, for labor productivity 129.1 and 131, and the proportion of output in the highest quality category rose from 8.5 percent in 1975 to 24.9 percent in 1978. In addition the number of plants not fulfilling the plans was considerably lower than for industry as a whole.

During the period of operating under the new conditions contributed additionally to the budget from above-plan profit was about 80 million rubles. The ministry used for development of production over 40 million rubles of above-plan profit, even in the presence of factors complicating the work: instability of the five-year plans basically for the reasons of their lack of balance with respect to material supplies and capital investments; refinement of the annual and financial plans with respect to volume of production and profit; the yearly change in wholesale prices for a considerable part of the output produced; the absence of the necessary reserves at different levels of management, which would have guaranteed stability of the plans. All this led to disruption of the stability of long-term norms, which sharply reduced their incentive value.

Practical implementation of the measures outlined by the decree will eliminate the shortcomings indicated above in planning and in the balanced nature of the plans and make it possible fully to disclose the potentials of the normative method of profit distribution.

Introduction of the normative method of profit distribution and guaranteed payments to the budget will force the ministries, associations and enterprises better to utilize fixed capital, to uncover additional reserves and potentials for creative activity of labor collectives, and to accept stepped-up plans for all technico-economic indicators. Thus, worked out in the Ministry of Agricultural Machine Building was a system of stepped-up plans which are determined depending on the coefficient of utilization of production capacities, loading of equipment, increase in output due to the introduction of organizational and technical measures and owing to growth in labor productivity, and an increase in the proportion of new output in the total volume of production. Depending on the degree of intensity of the plan adopted, the sum of incentive funds for the association or enterprise is increased.

One of the conditions of switching over to the normative method of profit distribution should be the guarantee of cost-accounting compensation of all outlays, including capital investment. In those cases when full compensation of outlays cannot be insured, the transfer of ministries and associations to normative distribution of profit is carried out with the use of bank credits.

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The normative method of profit distribution cannot be limited to the level of the ministry, or the industrial association, as is occurring in the Ministry of Instrument Building. It should be introduced at large enterprises and in production associations. However with a three-unit system of management, determination of the stable norms of profit distribution does have its difficulties. They consist in the differing profitability of associations and enterprises. In the current year the Ministry of Agricultural Machine Building and the Ministry of Power Machine Building developed a system of converting to the normative method of profit distribution for large production associations and enterprises.

Successful operation of ministries, associations and enterprises according to the normative method of profit distribution also depends on how correctly the prices are set, in which all the socially necessary outlays should be taken into account, and their stability should be guaranteed.

Defined by the adopted decree was the procedure for working out stable prices for a five-year period, and the conditions are created for further improvement of them on the basis of more complete reflection of socially necessary outlays in them. Further development of prices and consolidation of cost accounting will be aided by the development of a system of technico-economic norms and standards according to types of operations and outlays (saving) of labor, raw materials, supplies and fuel and power resources. Their utilization will make it possible to establish prices taking into account the effectiveness of the production-economic activity of associations, enterprises and organizations.

The economic mechanism provides incentives for the best use of production capital, and increase in the yield on capital, and rational utilization of material resources. For this purpose a fee for capital was established, which, as an economic lever, has not fulfilled its role in preceding five-year plans, although in individual ministries it has contributed to an increase in the yield on capital, to acceleration of the turnover rate of circulating capital, and to reduction of the amount of equipment not submitted by the established deadlines. At the enterprises the fee for capital was set in the amounts of from 1 to 6 percent, many concessions were allowed, and for a number of production funds the fee was not established at all. For industrial ministries the fee for capital came to from 11 to 15 percent.

The practice of profit distribution has shown that the normative method did not insure the due effectiveness of the fees for production capital. The main shortcoming was that the amount of the fee did not have due influence on the sum of the profit left at the disposal of the ministry, since with centralized settlements with the budget an increase in the fee for capital automatically entailed a reduction in the amount of contributions to the budget from the free remainder of profit, and a reduction in the fee increased these contributions. Naturally with such an interdependence of the two basic types of payments to the budget the economic lever, the fee for capital, did not operate.

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These and other factors weakened the stimulating role of the economic lever. In connection with this the development of measures to strengthen the role of the fee for capital was required. This work was conducted to a certain degree in the Ministry of Agricultural Machine Building, the Ministry of the Electrical Engineering Industry and the Ministry of Heavy Machine Building. In particular, the Ministry of Agricultural Machine Building worked out and introduced a mechanism of an additional intrasector fee for capital, the introduction of which greatly increased its incentive value.

However these measures did not affect the growth in the effectiveness of the fee for capital. An economic lever can operate optimally only if the collective receives an incentive for good work and is penalized for poor work. Unfortunately, the given principle was violated. The enterprise was penalized only for poor utilization of production funds and circulating capital, but when it attained positive results it did not receive an incentive.

The decree considerably increases the role of the fee for capital as an economic lever, stimulating effective utilization of production capital. Established in addition is a single 6-percent rate of the fee for capital; there is a reduction in the concessions for production capital for which a fee is not exacted; for above-plan and non-credited reserves of material valuables and uninstalled equipment the fee for capital is contributed to the budget owing to a reduction of that part of the profit which is left (according to the norm) at the disposal of the ministry, association or enterprise. And, on the contrary, in the case of fulfillment of production and profit with the least cost of capital (against the plan) the saving with respect to the fee for capital is left at their disposal with a simultaneous reduction in the sum of contributions to the budget. Introduced by the decree are measures for rational use of raw material, supplies and fuel and power resources in the national economy.

In the outlays for production of industrial output the expenditure of raw materials, supplies, fuel and power comprises about 75 percent on the average. This means that with the modern scales of production important significance is taken on by their economy, by rational utilization and reduction of losses during production, transport and storage, as well as the effective action of economic levers and incentives. For instance, the electric power engineering sector consumes up to 45 percent of all the fuel expended in the national economy. In addition, a saving of each gram of standard fuel per 1 kilowatt-hour of output of electric power yields an economic benefit of about 15 million rubles per year. Thus, the main task of the electric power engineering sector is the maximum reduction in expenditures of fuel for production of electrical and heat energy. For this purpose, established for power engineering enterprises of the USSR Ministry of Power was one of the basic indicators of operation--the reduction in specific norms of fuel expenditure.

As a result of introduction of such a system in the 9th Five-Year Plan the expenditure of fuel was reduced by 26 grams, and for the whole

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output of electric power this came to 21 million tons of standard fuel, which yielded a monetary saving of about 350 million rubles. The collectives of power enterprises participating in the saving received additional bonus awards amounting to 57.1 million rubles.

In order to increase the interest of associations and enterprises in the use of cheaper types of raw material, supplies, substitutes, and preservation of the quality of output on the former level with an actual determination of the volume of production and the productivity of labor it was authorized by the decree to keep the wholesale prices for this output without change until the end of the five-year plan.

When approving a wholesale price for an item with a smaller materials-intensity it is necessary to consider in the new price that profit which the enterprise earned from the sale of earlier produced output. Under these conditions the profit of an enterprise can only increase, which ultimately will lead to an increase in the effectiveness of production.

In the decree it is envisaged to introduce at the expense of the prime cost of output a fee for water taken by industrial enterprises from water management systems. Considering the large consumption of water by all sectors of the national economy, it is necessary to take measures for its economical expenditure.

Measures have been outlined for economical utilization of land resources. Land is the basic means of production in agriculture and requires a very thrifty attitude toward it. However in connection with population growth, with the withdrawal of land for urban, industrial, and road construction, for quarries for extraction of minerals and for other purposes, in the last 15 years about 10 million hectares have been taken out of circulation. Introduction of new irrigated lands requires colossal expenditures. Under such conditions it is impossible to allow wastefulness in land utilization. This is why in the new decree it is planned along with technico-economic substantiation of the construction of enterprises to consider the economic valuation of land parcels set aside for this construction.

The changeover of the economy to the intensive path of development advances the task of strengthening the organic link between science and production on the basis of deepening the processes of concentration and specialization of production, transforming production associations and scientific organizations into a unified cost-accounting complex capable of solving complex problems of scientific and technical progress. The many years of experience in development of the economy indicates that only large associations and enterprises can insure the introduction of significant individual capacities, more effective utilization of material, labor and financial resources, and concentrate an adequate number of skilled specialists and contribute to considerable growth in production and a rapid yield of an economic benefit from new technology.

An important part in improving the economic mechanism was played by the conversion in 1969 of the Ministry of the Electrical Engineering Industry

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and in subsequent years 13 more industrial ministries, scientific research, planning and design and technological organizations, associations and enterprises to the new system of planning and financing and economic incentives for work on new technology. On the basis of the accepted scientific and technico-economic directions of development of the sector, worked out and approved in these ministries are five-year plans for scientific research, experimental design and technological work. Insured in this way is continuity of the conduct of a whole complex of projects on each specific topic. Schedule-orders are compiled including all stages of development, the outlays, the ceiling price of the item, the quality category, sources of financing, the proportion of the economic benefit and the sizes of the incentive funds of each executor.

The financing, beginning with the scientific research and ending with the creation and assimilation in production of new types of items and with the introduction of new equipment and technological processes, is carried out at the expense of the unified fund for development of science and technology, which is formed in the ministries from the profit according to the norms in percentages of the planned volume of commodity output. The unified fund for development of science and technology has played a large stimulating role in acceleration of the whole "research-production" cycle, it has unified science and production in a single whole.

Before the conversion of scientific institutions and associations to the new system of planning and economic incentive, formed at the industrial enterprises were funds for financing scientific and technical projects, and for development of new equipment at the expense of deductions from the prime cost, and if there was a shortage of these budgetary allocations were made for scientific research. With such a diversity of sources and funds often the quality of the projects was worsened, and the times for development and introduction of new technology were drawn out.

All these shortcomings are eliminated with the creation of a stable source for financing the development and introduction of new technology. Moreover, the sphere of utilization of the unified fund for development of science and technology is expanded. At present owing to this fund important scientific research projects will be financed, and in the case of inadequacy of the fund loans and means from the state budget will be used. In case of need some of the monies of the fund will be transferred to the disposal of industrial associations and large production associations and enterprises.

The cost of the operations connected with assimilation and introduction of new technology and implemented at the expense of monies from the unified fund for development of science and technology will be counted in the total volume of production with the entry of the normative profit according to corresponding groups of items. Being introduced in the machine building sectors of industry are one-time awards for development and assimilation of the production of especially important and highly effective types of

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machines, equipment, and technological processes. Payment of the bonuses will be secured owing to the money in the fund for development of science and technology.

An important role in accelerating the introduction of new equipment and increasing its effectiveness has been played by the change in the principles of formation of the economic incentive funds in scientific institutions, associations and enterprises. Now the incentive funds are formed owing to part of the national economic benefit, and not from the wages, as was done previously, which makes it possible to make the incentives for scientific collectives dependent on the national economic benefit, and to eliminate the levelling tendency in paying incentives to collectives and individual workers.

As a result of the conversion of scientific organizations to cost accounting, the times for working on and introducing developments have been reduced. Thus, in the Ministry of the Electrical Engineering Industry they were reduced on the average by 20-40 percent, and in the Ministry of Power Machine Building and the Ministry of Heavy Machine Building they were reduced by 30 percent. In relation to the first year of operation according to the new system the total annual economic benefit increased in the Ministry of the Electrical Engineering Industry 6.6-fold in 9 years, in the Ministry of Heavy Machine Building and the Ministry of Power Machine Building it increased respectively 2.3- and 2.2-fold in 5 years, and in the Ministry of the Chemical Industry it increased 1.2-fold in 3 years.

An important stimulus for speeding up the introduction of new equipment is the establishment of incentive surcharges in the wholesale prices for output of the highest quality category. These surcharges insure compensation to the manufacturer of the outlays for producing output of improved quality and an additional profit directed to the incentive funds of scientific institutions and enterprises. With the wholesale prices for output attributed to the second quality category, set for the manufacturing enterprises are rebates subject to being contributed to the state budget.

The surcharges and rebates are not taken into account in the plan. With regard to actual fulfillment of the plan, when it is being evaluated the sums of the surcharges and rebates are taken into account. If output of the second quality category is sold, the discount in the price is considered only for the supplier-manufacturer which has violated the plan of removing out-dated output from production. The consumer pays for this output according to the wholesale price.

Established in the plan indicators for ministries, associations and enterprises is the proportion of output of the highest quality category in the total volume of commodity production, depending on which the incentive funds are figured. Planning the quality of output, and certification of it by categories in combination with economic levers and stimuli have made it possible even in the 10th Five-Year Plan to increase significantly the release of output of the highest quality category and to remove

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out-dated products from production. Thus, in the Ministry of the Electrical Engineering Industry the proportion of output of the highest quality category increased from 9.6 percent in 1969 to 42.7 percent in 1978, in the Ministry of Power Machine Building and the Ministry of Heavy Machine Building during 1972-1978 it increased respectively from 9.3 to 22.4 and from 6.8 to 29.4, and in the Ministry of the Chemical Industry it increased from 3.1 in 1974 to 20.5 percent in 1978.

The proportion of output of the second quality category (output subject to removal from production) was reduced: in the Ministry of the Electrical Engineering Industry from 14.2 percent in 1971 to 1.2 percent in 1978, in the Ministry of Heavy Machine Building respectively from 1.6 to 0.08 percent, and in the Ministry of Power Machine Building from 1.7 to 0.01 percent.

In order to increase the role of economic levers and stimuli in expanding the release of high quality output and removing out-dated output from production, the decree provides for an increase in the sizes of incentive surcharges on the wholesale prices for new highly-effective output and an increase in the period during which they are in effect. For output of the second quality category, and also for output which has not been certified within the set deadlines there is a sharp increase in the size of the discount (the discount will come to 50 percent of the profit), and after elapse of the deadline for removing output of the second quality category from production the discount is set in the amount of the full sum of the profit, which is transferred into the budget.

Noted in the decree is a series of other measures for improving planning and strengthening economic levers and incentives for the purpose of accelerating the introduction of scientific and technical progress.

It is planned in 1980 to complete the transfer of scientific institutions, associations and enterprises of all industrial ministries to the cost accounting system of organization of operations for creation, development and introduction of new technology on the basis of schedule-orders (contracts).

In the course of preparing the five-year plan, the production associations (enterprises) work out and independently approve measures for technical retooling of production: mechanization and automation, replacement and modernization of equipment, improvement of the organization of production and labor, and others. All this is implemented from the means of the production development fund, which is formed owing to in-house profit, deductions from amortization and earnings from the sale of withdrawn capital.

The outlays for the indicated measures are backed by the necessary capital investments, material resources and volumes of contracting jobs in the limits of the ceilings set by the ministries and departments in the five-year plans (with a breakdown by years). In those cases when in the course of fulfillment of the annual plan the need arises to conduct additional measures, the corresponding outlays are made above the ceiling of the

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state capital investments at the expense of the unutilized means of the production development fund and the above-plan contributions to this fund.

The important directions of the economic initiative of labor collectives will receive further expansion of their cost-accounting rights in the formation of economic incentive funds in relation to the improvement of the end results of the work, including the production development fund.

In the new procedure for formation of the material incentive fund more significance is given to quality indicators, since the amounts of the incentive funds in the five-year and annual plans are made directly dependent on the growth in labor productivity and production of output with the highest quality category (or another indicator of the quality of output established for the given sector). Envisaged during formation of the material incentive fund is a sharp increase in the role of the profit indicator in determining the amounts of this fund. Money is put into the material incentive fund according to norms established in relation to profit. Thus, the profit indicator becomes the third fund-forming indicator, which to a significant degree determines the size of the material incentive fund.

The absolute sum of contributions to the material incentive fund also will be increased (reduced) in relation to fulfillment of the plan for deliveries according to the nomenclature (the assortment and deadlines in accordance with the economic contract-orders).

The fund for social and cultural measures and housing construction will be formed in the amount of 30-50 percent of the material incentive fund. In some ministries incentive funds can be created according to the indicators reflecting the specifics of the sectors of industry. Included in such indicators are the saving of material resources, increase in yield on capital and the shift index, and reduction of the prime cost of output, and in the extractive sectors the growth in production of output in physical terms.

The experience in providing incentives for ministries, associations and enterprises for indicators which consider the specifics of the development of individual sectors in the 9th and 10th five-year plans has yielded its positive results. For instance, the electric power engineering sector requires a different approach to establishment of plan and fund-forming indicators. In the Ministry of the Petroleum Industry and the Ministry of the Coal Industry the formation of the funds is done taking into account the use of rates for each ton of extraction of oil or coal, which makes it possible to insure the interest of the collectives of associations and enterprises of the ministries in achievement of the final goal.

Translating the decree of the CPSU Central Committee and the USSR Council of Ministers into reality will create conditions for considerable expansion and strengthening of cost accounting and increasing the economic effectiveness of industrial production.

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UTILIZATION OF RESOURCES AND SUPPLY

CALL FOR CONSTITUTIONAL BODY TO MONITOR NATURE CONSERVANCY

Moscow VOPROSY EKONOMIKI in Russian No 6, Jun 80 pp 75-86

[Article by M. Gokhberg: "Regional Use of Natural Resources"]

[Text] The principles of the conservation and intelligent use of natural resources characteristic of the period of developed socialism are reflected in the USSR Constitution: "In the interests of the present and future generations the essential measures are being adopted in the USSR for the conservation and scientifically substantiated, intelligent use of the land and its interior, water resources and flora and fauna, preservation of the purity of the air and water, the reproduction of natural resources and an improvement in man's environment."

A further improvement in the planning of the economy is of importance for the implementation of nature-conservation measures and the intelligent use of natural resources. The CPSU Central Committee and USSR Council of Ministers decree "An Improvement in Planning and an Intensification of the Impact of the Economic Mechanism on an Increase in Production Efficiency and Work Quality" provides for the systematic development of problems of the comprehensive use of natural resources in the process of preplanning work. The USSR ministries and departments and union republic councils of ministers have been charged with formulating and confirming in the 5-year plans natural and environmental conservation measures and also plans for the use of incidental output and byproducts, secondary materials and other resources. It is also planned in the said decree "to formulate as a most important component of the state long-term plans of economic and social development object comprehensive scientific-technical, economic and social programs and also programs of the development of individual regional and territorial-production complexes, insuring these programs' essential linkage with the corresponding sections of the plan and with material and financial resources." Topical significance is attached in this connection to a study of the economic problems of the regional use of natural resources on the basis of a program-goal approach presupposing the interconnected examination of a number of modules: the first would be mineral-raw material and fuel resources (geological prospecting, recovery, enrichment and final processing and the use of secondary resources);

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the second--forestry, timber, wood-processing and pulp and paper industry and timber transportation; the third--water resources (surface and subterranean, water supply and drainage, reclamation, hydraulic power, navigation, fishing and the use and conservation of lakes and small rivers); fourth--land and its agricultural and nonagricultural use; fifth--the air (its condition, sources of pollution and ways of purifying harmful discharges into the atmosphere); and the sixth would include landscapes and flora and fauna preservation zones. Resources, requirements, comprehensive utilization and methods of economic evaluation would be studied within the confines of each module. The specified forecasts should have a precise regional aspect and be distinguished by a differentiated approach which takes account of the concrete singularities of each economic region (kray, oblast, ASSR) and territorial-production complex.

The scientifically substantiated, intelligent use of land and its conservation and the utmost increase in soil fertility is a nationwide task. But there are certain shortcomings in this sphere. A trend toward a reduction in agricultural land, including arable land, can be observed. Considerable damage is being inflicted on agricultural land and its fertility as a result of contamination of the soil by solid waste and chemicals, the mining of minerals by the open method, the building of supply lines and installations and the siting of dumping grounds.

Despite the constant detachment of fertile land for housing, development, warehousing, industrial and other purposes, the nonagricultural territories are being utilized insufficiently intensively. Thus approximately only 80 percent of industrial territories in the USSR's Central economic region is built up and occupied by supply lines and sanitation-protective zones. However, even this section of territory is utilized inefficiently. The average density of housing development per hectare of development territory of this region's cities amounts to approximately 600 square meters because the proportion of low apartment houses in the cities' housing amounts to 40-50 percent. Over the last 10 years 60 percent of the urban communities of the said region have been developed from the assimilation of agricultural land, 35 percent from open areas and only 2 percent from recultivation. With a low density of development, only 6-18 persons reside per hectare of development territory of the villages in rural localities, whereas even with 1-2-story modern capital development it would be possible to settle 40 and more persons (with a density of 600 square meters per hectare). Agricultural land is frequently allocated for construction here.

Considerable shortcomings are typical of the current system of compensation for economic loss in the detachment of land. The USSR Council of Ministers decree "Compensation of Losses for Land Users and Losses of Agricultural Production Upon the Detachment of Land for State or Public Needs" was adopted in 1974. However, the amount of compensation per hectare of detachable arable land does not exceed 10-50 percent of the actual summary outlays necessary to recover the land and its fertility. The norms of the development of new land to replace that detached for agricultural needs

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applicable since 1976 provide for compensation in the Central economic region of R5,790 per hectare of arable land and R3,120 per hectare of fodder land. Thus there is reimbursement, as it were, of outlays for the development of 1 hectare of new land. In nonchernozem zone practice they exceed R10,000 (taking into account outlays on the recovery of soil fertility). The process of the development of new land under the conditions of Moscow Oblast takes no less than 4 years. In this period the farm loses a harvest and the gross income connected therewith of R5,600 per hectare (it amounts to approximately R1,350-R1,400 per year).¹ The specific land users are not compensated for the losses of agricultural products. Moreover, in the event of a decision having been made on the detachment of land any amount of compensation is in practice no barrier to the seizure of the land since it is planned in the estimated costs of the new project, constituting a negligible part thereof.² The ministries and departments do not here transfer the amounts of compensation to the accounts of the land user-farms which ran the detached land. These new resources are put at the disposal of the union republic Ministry of Agriculture and may be used for any needs. Thus there is a loss of the lower-level land users' responsibility both for the detachment and also for the recovery of land according to the principle of "a hectare for a hectare and a quintal for a quintal." As a result specific farms of a rayon and oblast lose a percentage of fertile land and the harvest.

Often the land user-farms do not object to the removal of some of the land, particularly the less fertile land, since this spares them the need to improve it and enables them to lower the plan and reduce the work load. Material of the interdepartmental commissions for locating new industrial construction projects in the krays and oblasts shows that fertile land is frequently detached without sufficient justification.

The shortcomings of the current system of compensation for the detachment of agricultural land demand a quest for new ways of regulating this process. A proposal of the All-Union Scientific Research Institute for Prices on the introduction of a system of measures including the determination of a one-time fee for detachments of land, annual payments for its use and fines for the nonfulfillment of recultivation plans and an increase in the area and violation of the density norms of the industrial development is very interesting.

An enterprise's financially autonomous activity under these conditions requires the planning of the necessary compensation amounts to cover the one-time fees for detachments of land and the annual payments for its use. Irrespective of their magnitude, fines cannot appreciably influence enterprises' profit surplus and the economic stimulation funds being formed. It seems to us that an extra-economic factor in the form of a system of judicial measures combined with effective economic measures insuring the creation of sources for the recovery of fertile agricultural and forest land could play a decisive part in their protection in the immediate future. It is evidently advisable to detach for nonagricultural purposes predominantly land which is the least fertile and which has an intricate relief and broken soil cover

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and which is barely suitable or unsuitable for agriculture. The transfer of arable and other most valuable land for nonagricultural needs should also be prohibited. Together with this it is necessary to step up work on increasing soil fertility, combating wind and water erosion, on afforestation, draining excessively moist land, recultivating peat soils, sand and sandy loam soils and on fundamentally improving forests and pastures. In addition, a reduction in the need for additional territories is possible thanks to the better use of land detached earlier, the development of subsurface areas, acceleration of the dimensions of reconstruction work in urban and rural communities accompanied by the extensive enlistment of "unproductive" and vacant land and an increase in the density of housing-civil and industrial construction by means of an increase in the number of stories in a building, the demolition of 1-2-story buildings, the group location of enterprises, the ordering of industrial areas on the basis of rational layout plans and the recultivation of broken land.³

These measures are of particular significance for the highly developed and completed economic regions (the Central, Donetsko-Pridneprovsk, Ural and others, for example), where the possibilities of expanding agricultural land are not great. In these regions it is important to reduce detachments of agricultural land to a minimum and to rule out detachments of arable land and state forestry land altogether and to establish increased economic penalties for the irrational use of land resources, arbitrary seizure, contamination and harm caused to the fertility of the land.

Detachments of agricultural land permitted as an exception should be compensated on the basis of the principle of economic evaluation envisaging the need for the reimbursement not only of one-time outlays on the recovery of land of an analogous area and fertility but also of the gross income lost in the period from removal of the area to the introduction of the new land. It would be expedient here to allow for an 8-year period, which corresponds to the average normative coefficient of the effectiveness of capital investments of 0.12.⁴ The following formula may be adduced to determine the overall amount of compensation (C):

$$C = \frac{Y_a \cdot A_s \cdot P_z}{1.12} + C_e, \quad (I)$$

where Y_a is average yield per hectare (in accordance with the figures of the region's best farms); A_s is the area of the seized plot; P_z is the zonal purchasing price, which takes account of location and soil fertility (with the land quality being defined on the basis of the land evaluation register); and C_e is the estimated costs of the recovery of the land, including outlays on reclamation and agricultural development. Calculations show that with a gross income of R1,400 per hectare the amount of compensation according to the above formula equals R17,000 per hectare (in accordance with the established norm, it amounts to R5,790 per hectare of arable land

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for the Central economic region). It would appear advisable to pass on the amounts of compensation to the farms (or local agricultural authorities) which used the detached land and strictly monitor the use of these resources for the purpose of introducing new land in a specific region. We believe that it is better to detach recently reclaimed land for construction rather than developed and more productive land (when there are no other alternatives).

The quest for areas of the conservation and intelligent use of land resources and finding opportunities for expanding agricultural land and economizing on land detached for nonagricultural purposes are important tasks of regional preplanning research. It is advisable in the course of this work to study ways of intensifying the use of agricultural land on the basis of optimization of its structure and the introduction of progressive crop rotations and efficient agrotechnical methods. It is also necessary to study the possibilities of expanding land resources thanks to drainage, irrigation, the implementation of anti-erosion measures, the clearing of stones and shrubs and recultivation. Determination of the paths of the efficient use of assimilated land should be based on calculations which take into consideration in a package the singularities of the specific region. For example, the implementation of such measures is marked by high effectiveness under the conditions of the RSFSR's nonchernozem area: the yield on reclaimed and recovered land frequently amounts to 200-400 quintals per hectare of potatoes, 400-800 quintals per hectare of cabbage, 400-600 quintals per hectare of fodder root crops and 120-400 quintals per hectare of green bulk (on irrigated land), and the time needed to recoup expenditure is 3-4 years. In addition, it is necessary to formulate proposals on protecting land against contamination and irrational use and on locating industrial and housing-civil construction on unsuitable or barely suitable land and also to reduce territory requirements thanks to the concentration of developmental buildup and an increase in the number of its stories and rational use. We believe it necessary in the long-term forecasting of the regions to pay particular attention to an analysis of the balance sheet of land resources and agricultural land for uncovering reserves of unutilized land. Such reserves exist, for example, in many oblasts of the Central economic region, and their amounts fluctuate between 2,000 and 10,000-plus hectares. It is essential in the elaboration of long-term forecasts to study the dynamics of land detachments for nonagricultural purposes and the amounts of compensation for the removal of land and its use. It is advisable through the efforts of specialized organizations to formulate for each economic region (kray, oblast and ASSR) long-term outlines of the comprehensive application of land, the basis of which should be the Master Outline of the Use of the USSR's Land Resources.

The problem of the rational use, preservation and reproduction of forest resources is urgent for all regions of the country and particularly for the European part of the RSFSR, which has less than 20 percent of the economically practicable forest resources of the entire republic and a volume of timber procurement in excess of 50 percent of the all-union volume. Excessive

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felling of designed forest areas of coniferous species is leading to their gradual diminution, while a large amount of deciduous timber remains in the forest cutting areas. A reason for the depletion of the European part's forest resources is the big timber requirement, which we have not yet succeeded in satisfying from heavily wooded and forest-abundant regions on account of their insufficiently rapid assimilation. The inefficient utilization of deciduous timber is engendered by its inferior quality compared with coniferous timber and a shortage of processing capacity. The shortage of timber is also caused by the low level of its industrial application, which frequently does not exceed 20-25 percent. Insufficient use is being made of waste, although it is known that out of 1,000 cubic meters of timber waste it is possible to obtain products worth R44,000, that is, no less than from the same quantity of finished timber. Preservation of the ecological balance in the regions of the country suffering from inadequate forests demands that forest resources' habitat-forming, hydrometeorological and sanitary significance be adopted as chief criteria of their use. In the interests of protecting the surrounding air of highly developed economic regions it is important that this principle prevail over the category of the industrial value of the forest and its proximity to the consumer. An overall magnitude of maintenance felling and sanitary felling and of the use of mature and overmature forest is proposed as the quantitative criterion of determination of the size of the effective cutting area and the felling volume. It is advisable to put an end to excessive felling of the designed cutting areas in coniferous forests and primarily water-protection forests and improve the consumption of deciduous timber and the entire timber raw material complex. In addition, it is proposed to plan in the regions of the European part of the country suffering from insufficient forest areas, particularly in the Central, Donetsko-Pridneprovsk, Ural, North Caucasus and other regions, a radical increase in the scale of forest restoration and forest cultivation, making it possible to compensate for annual losses and undertake the expanded reproduction of forest resources at an accelerated pace. It is essential to rule out entirely the use of forest areas in these regions for construction needs.⁵

The limited nature of the forest resources and the increase in outlays on their protection and reproduction presuppose an increase in the fee charged for use of the forest on the basis of differentiated forest rates (in the form of a per-stump or per-root payment which takes account of the complex of the natural and economic singularities of the use and reproduction of these resources in given regions and the actual outlays conditioned by these factors and also the differentiated revenue determined in accordance with the conditions not of the average but of the worst areas).⁶ This provision is particularly important for the regions which suffer from inadequate forest areas. The forest land register, which reflects the qualitative regional characteristics of the forests and the singularities of their increase and location, should be made the basis of an evaluation of forest land.

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An analysis of the forest land of krays, oblasts and ASSR's, a study of the paths of its conservation and reproduction, an improvement in the use of timber and an improvement in the territorial organization and location of timber, wood-processing and pulp and paper industry are an inalienable part of the long-term forecasting of the development of the economy of economic regions.

It is necessary to seek paths for the intelligent use of water resources as a consequence of the shortage thereof in a number of regions of the country. Thus the western and southern regions, which are the most developed and densely populated, have only 14 percent of them. The European regions of the RSFSR have approximately 23 percent of total water resources, while the amount of water consumption in them is as high as 80 percent of republic-wide consumption. This is explained by the insufficiently rational consumption of water in the economy. The position with regard to water supply is frequently exacerbated on account of the unsuitability of surface waters for this purpose. A study of hydroeconomics at the regional preplanning research stage should include: an evaluation of the resources of surface and subterranean waters and their correspondence with the economy's requirements on the basis of a hydroeconomic balance sheet (with regard for the quality of the water) and the disclosure of territories which are deficient in water resources. Urgent significance is attached to the interconnected examination of the problems of hydroeconomics, the comprehensiveness of the use and protection of water sources, the conditions of water supply and drainage, and the purification and repeat use of effluent in connection with the interests of hydraulic power, navigation and fishing and land reclamation in each region. As experience shows, it is advisable to study water resources with respect to water basins as a whole, krays, oblasts and ASSR's, territorial-production complexes and industrial centers and agricultural zones. In studying regions' provision with water resources it would appear important to examine the position of the principal water consumers and areas for the location of new facilities with respect to sources of water supply. An evaluation of surface waters will be made here in accordance with the following indicators: overall resources in years of average water content, including natural and transit flow; proportional water resources per square kilometer and per inhabitant; and dimensions of the flow being built up within the confines of a region (absolute amount of the flow in cubic kilometers in average and high-water years; its specific indicator in liters per second per square kilometer; and minimum average monthly discharges in the summer-fall and winter seasons). An evaluation of the resources of subterranean waters presupposes a study of artesian basins (magnitude of the resources, quality of the water, depth of occurrence, capacities of the aquiferous lines and possible amounts of the yield and daily flow of the wells). Together with this it would be advisable to analyze the dynamics of outlays on hydrogeological and hydrological work, which are still insufficient in many regions.

The growing deficit in the balance sheet of subterranean waters demands that we limit or rule out their use for industrial purposes. For this reason it is necessary to study the areas of the use of subterranean waters and paths of improving them in preplanning regional research. A high-quality analysis

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of water resources presupposes the study of the composition of subterranean and surface water from the viewpoint of their suitability for industrial and household-drinking water supply and also disclosure of the principal sources of pollution and the nature of them.

In analyzing the problem of protecting water resources it is advisable to employ the following indicators: the relation of the volume of the flows requiring purification to the overall quantity of polluted water; the relation of the volume of the flows which have undergone purification (chemical, mechanical and biological) to the overall volume of dischargeable sewage; the relation of the capacity of the purification installations providing for the total purification of the flows to the total capacity of the purification installations; and the relation of the actual capacity of the purification installations to the volume of polluted effluent. This analysis will be supplemented by a study of the progress of fulfillment of the plans for the assimilation of capital investments and the introduction of purification installation capacities. These indicators characterize, we believe, the state of the system of the purification of effluent in the region (city).

A comprehensive approach to an investigation of regions' water resources presupposes a study of the conditions of the preservation and reproduction of flora and fauna, ways of improving navigation and the intelligent use of coastal land in the regions. The problem of the resources of lakes and small rivers, which may be employed for water supply, hydraulic power, local navigation and the organization of fishing and their bottom land for obtaining big stable harvests of fodder grasses and vegetables, merits particular attention.

Redistribution of the flow of the northern and Siberian rivers will be necessary in the future as a source of replenishment of the water resources of the European and Central Asian regions. Importance is attached in this connection to a study of the natural, climatic, economic and other consequences for a number of regions of the country and also of the problems of the intrabasin and interbasin distribution of the flow within the European and Central Asian regions.

The growing need for water and the limited nature of resources of it demand regulation of the water supply with the aid of economic levers. The established charge for water in a number of sectors and regions does not fully take account of the expenditure of socially necessary labor on the implementation of hydroeconomic measures in the country as a whole. We do not practice differentiated amounts of the charge for water per region with regard for the quality of the water and its critical nature and efficient utilization. This expenditure can be taken into account only on the basis of a correct determination of rent payments consisting of a charge for the water. There are various opinions with regard to calculating prices for water. But a unified approach to this question has yet to be formulated. Until the charge for water is determined on the basis of the incorporation

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of rent payments therein, it may be based on the specific indicators of adduced expenditure in different regions (with regard for the socially necessary expenditure in the country as a whole).⁷ Perfection of the principle of the chargeability of the use of natural resources will promote the rational use of water resources. This problem is assuming importance for the highly developed economic regions of the European part of the country, which are experiencing a shortage of water of the necessary quality for industrial and household-drinking water needs. We believe that it would be advisable to establish for these regions legislative restrictions with respect to the creation of new and the development of operating water-intensive works and also production facilities distinguished by harmful effluent which is difficult to purify. It is also necessary to rationalize water consumption on the basis of the introduction of economically progressive norms which take account of the need for the complete transition to return water supply⁸ and to perform work on an extensive scale to strengthen the sanitary protection of the reservoirs and channels. Importance is attached to an increase in the rate of flow of the rivers (regulation of the flow and intrabasin and interbasin redistribution), the establishment of legislative restrictions on the use of subterranean waters for industrial purposes and intensification of the comprehensive approach to problems of water supply, drainage and protection of the water basin. It appears essential to introduce the chargeability of water utilization (with differentiation per region and with regard for the quality, critical nature and efficiency of consumption of the water and the incorporation of rent payments in the charge for the water). It should be pointed out that the effect from the interbasin transfers of the flow of northern rivers to the European regions which is planned in the future could be achieved given a fundamental improvement in the sanitary condition of these regions' water basin.

The development of long-term forecasts of the development of the production forces of economic regions (krays, oblasts and ASSR's) requires a detailed analysis of previous geological study of the territory. We believe that the level at which it is covered by various kinds of geological survey broken down by degree of detail (large-scale, medium-scale and small-scale) could serve as an indicator. This indicator is defined as the relation of the area covered by this type of geological survey or the other to the entire magnitude of the territory. An analysis shows that in a number of oblasts of the European part of the country the extent of coverage by a large-scale survey fluctuates within the limits of 25-30 percent, by a medium-scale survey within the limits of 60-65 percent and by a small-scale survey within the limits of 40-45 percent. This is negatively reflected in the extent to which the territory has been geologically tested. Importance is attached to a study of the tendency of geological prospecting on the basis of an analysis of the scale, dynamics and structure of planned and actual expenditure (of the krays, oblasts and ASSR's) over a period of 2-3 five-year plans. We believe that it is essential to utilize the following indicators for this: rate of growth of expenditure and shifts in its structure; and proportional expenditure on geological prospecting for individual types of raw material per 1,000 square kilometers of territory of the kray, oblast, ASSR and economic region. These indicators may be compared with analogous

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indicators for the country as a whole and the union republics. The extensive application of the balance method is essential in the process of regional long-term forecasting provision with mineral raw material (fuel) resources [as published]. The technical-economic evaluation of mineral raw material is a task for the specialized scientific research and planning organizations. However, regional digests of the location of mineral raw material resources are not of a regular nature, and the possibilities of their use are limited.

The long-term regional forecasts pay great attention to problems of the comprehensive use of mineral raw materials and the maximum reduction in losses in mining, concentration and metallurgical treatment. The solution of this problem is a most important factor of a reduction in materials-intensive-ness, an increase in social production efficiency, saving resources, obtaining valuable elements and so forth.

It is essential in the forecasting of the development of the regions to study the degree of comprehensiveness of the use of the raw material in nonferrous and ferrous metallurgy and the chemical industry. This is particularly urgent when it comes to the use of copper-pyrite, compound copper and copper-zinc, tin-polymetallic, tungsten, molybdenum and tantalum-niobium ores, concentration tailings, slag, sludge, pyrite cinders, mining and chemical raw material and oil. It is important to uncover the shortcomings in the comprehensive use of raw material. These include: a departmental approach, whereby it is planned to obtain only individual components; a low level of production combination, which fails to insure the extraction of valuable elements; shortcomings in the organization of the investment process, wherein capital investments are channeled predominantly into the mining and treatment of individual components; and the unfinished nature of production processes and the imperfection of essential equipment, reagents and materials. It is advisable in the course of the long-term forecasting of the regions to make a quantitative and qualitative analysis of the resources; reveal the extent of the provision with reserves in the actual or planned mining yield; evaluate the mining and hydrogeological conditions of the working, the technological possibilities of concentration and the parameters of extraction into concentrate and the final product; compare the economic indicators for deposits and basins; and determine the need for the development of deposits, proceeding from the requirement established on the basis of the balance sheet of this type of mineral or the other. The economic evaluation of mineral raw material should be of a comprehensive nature and based on a consideration of mining and geological conditions and technological singularities of the mining, concentration and final conversion and also cost factors and be oriented toward final national economic results. An evaluation of the use of mineral raw material according to the criterion of a differential rent is successful. But this idea has not been implemented in practice. We believe other effective methods of an evaluation of mineral raw material for regional investigation are also possible: determination of the difference between the cost of the extracted components (in current wholesale prices) and the amount of expenditure on the mining and treatment of

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the raw material; a calculation of the time needed to recoup capital investments from profits, which is compared with the normative, sectorial average or the best indicators of national and foreign practice; and comparison of specific indicators of capital outlays, prime costs of the mining and treatment of individual types of minerals and also adduced expenditure. A systemic approach to an economic evaluation of mineral raw material demands computation of total expenditure on exploration, geological prospecting and preparatory operations, on concentration and metallurgical treatment and so forth.

Upon an evaluation of multicomponent raw material it would appear necessary to determine the value of all the extracted components according to current wholesale prices and to distribute capital and operating expenditure among them proportionate to the value of each of them. The prime cost of the ore or concentrate of the main type of raw material may be reduced by the value of a secondary component. It is necessary to proceed here not from the actual content of the secondary components in the source raw material or intermediate product but from the actual indicators of their extraction into a final product.

In a 28 November 1979 decree the USSR State Committee for Science and Technology and the USSR State Committee for Prices approved the "Provisional Model Procedure of the Economic Evaluation of Mineral Deposits." It takes as the basic criterion the national economic effect in the form of the difference between the value of the final product determined on the basis of the final expenditure indicator and total production expenditure. Together with this it recommends indicators of the time needed to recoup capital investments in the prospecting and working of the deposits, the annual profit total and others. A norm was also established for adducing expenditures at different times and results, making it possible to take account of the time factor in evaluating the use of capital investments.⁹

An improvement in the comprehensive use of minerals demands: the organization of strict quantitative and qualitative accounting of each type; the creation of technological possibilities of preserving main and secondary components in the semifinished product at intermediate treatment stages; and the determination of an effective system of the economic stimulation of the maximum extraction of raw material.

The 25th CPSU Congress pointed to the need to reduce materials-intensiveness as an important task of an increase in social production efficiency. One way to reach this goal is to reduce industrial waste and make fuller use of it. "This waste--irrespective of the role which it performs as new components of production--reduces to the extent that it can be resold raw material costs...."¹⁰ For this reason the application of secondary resources is important in regional preplanning research. It is advisable to study therein the amount of secondary resources and ways to evaluate the degree of utilization of secondary resources in the regions: the relation of utilized quantities of secondary raw material (fuel) per type to their availability in the region and also to the overall volume of consumed primary raw material (fuel, heat).

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This problem is of importance for the country's developed economic regions, where large reserves of secondary raw material are being built up and where there is a lack of large-scale mineral resources. The application of secondary resources in these areas will contribute to a reduction in expenditure on imported raw material and will increase social production efficiency. Thus in the Central economic region the available resources of scrap copper make it possible to cater for the operation of a copper-smelting plant. Use is made of 70 percent of ferrous metal waste and metal scrap. There is a low level of utilization of iron (carbonaceous) pyrite--important coal-mining waste from which it is possible to obtain concentrate with a 47-percent sulfur content and fire clay for the production of chamotte. The extraction of sulfur from this secondary raw material requires three times less added expenditure than from nonferrous metallurgy waste. The use of 1 million tons of carbonaceous pyrite instead of Ural sulfur-bearing raw material could insure a saving of added expenditure of more than R100 million a year. However, dumps thereof increase annually by several million tons. A large proportion of blast furnace, dump and power engineering slag and ashes is not utilized, and inadequate use is made of the granulated slag and fluxing limestone of ferrous metallurgy, although high-grade cement and construction materials (panels, blocks and light cinder fillers for the production of concrete and panels) may be obtained from them. For example, grade 300 slaggy Portland cement from slag of the Kosogorsk Foundry is approximately R3.5 per ton cheaper than that of the Podol'sk Cement Plant, where primary raw material is used. In addition, it is known that 1 ton of cement containing cinders costs R1.2 less and that the use of panels from cinders and slag makes it possible to reduce prime costs per cubic meter of structure by R10-18 and to reduce wall weight by a factor of 4-5 compared with the use of brick. Yet consumption of power station cinders and slag does not exceed 2 percent. The cinders of Moscow area coals are valuable raw material for the alumina industry. They contain 1.4 times more alumina than other types of aluminiferous raw material, and expenditure is lower. According to data of the Mineral Fuels Institute the Council for the Study of Production Forces and the Institute of Applied Chemistry, added expenditure on obtaining 1 ton of alumina constitutes (in rubles): 1.5 from Moscow area coal cinders, 20-36 from bauxites, 26 from nepheline concentrate and 18 from China clay. Therefore the use of coal cinders is expedient for alumina production.

Importance is attached for regional preplanning research to secondary power resources (the waste of coal concentration and wood processing, blast furnace and cracking processes, coal-tar chemical operations, the heat of exhaust gases, discharged hot water and steam and others). For example, it is possible to provide for 30 percent and more of the fuel requirement (data of I. P. Krapchin) as a result of their application in ferrous and nonferrous metallurgy and petroleum refining and chemical and petrochemical industry. However, secondary energy resources are only utilized to the extent of 10-15 percent in the industry of the Central economic region.

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It is essential in the process of regional preplanning research to pay due attention to questions of protecting the atmosphere (the implementation of radical measures to purify emissions into the atmosphere by industry, motor transport and municipal services). It is also advisable to study ways of restricting individual transportation means in the biggest cities and of establishing a strict system of control and economic penalties for air pollution, including sanitary control of motor-transport emissions.

In addition, it is necessary to broaden the front of work on studying valuable natural facilities, including recreation zones and health resorts, conservation of flora and fauna and the most characteristic landscapes, on substantiation of the recommended protective practices and on the creation of improved registers for all types of natural resources, including the atmosphere.

We believe that the consistent implementation of the nature-conservation laws requires the creation of a special constitutional body for planning, procedural guidance and monitoring the fulfillment of nature-conservation measures in the country and the union republics, primarily in such a major union republic as the RSFSR.¹¹ The limited nature of the natural resources engenders the need for the speediest transition to the chargeability of the use of natural resources based on the mineral, land and water resources and surrounding air registers.

The economic evaluation of natural resources is possible by means of a computation of expenditure on their assimilation and reproduction or by proceeding from the maximum permissible (final) expenditure on the output of the sectors exploiting the natural resources. Determination of differential rent rates is also probable on the grounds of optimized calculations oriented toward maximum rent proceeds. But with any method of the determination of differential rent it is advisable that its absolute amount for each type of natural resource correspond to the expenditure of socially necessary labor on conservation and expanded reproduction and the country's budgetary possibilities at this or the other stage of the economy's development. The transition to the chargeability of the use of natural resources acquires particular relevance in the light of the decree "An Improvement in Planning and an Intensification of the Impact of the Economic Mechanism on an Increase in Production Efficiency and Work Quality."

The expansion of the planning horizon outlined in the decree dictates the need for the transition to the systematic development for periods of 20 and 10 years (broken down by 5-year plan) of comprehensive forecasts with respect to the conservation and rational use of natural resources and the preservation and improvement of the environment in the country as a whole, the union republics, economic regions (krays, oblasts and ASSR's) and the most important territorial-production complexes by the efforts of the sectorial and territorial scientific research and planning institutes. The coordination of this research could be undertaken by natural-resource forecasting departments which it would be expedient to create in the system of the scientific research institutes of the USSR Gosplan and the union republic gosplans.

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FOOTNOTES

1. These indicators are typical, for example, of the "Safonovskiy" Sovkhoz of Moscow Oblast's Ramenskiy Rayon.
2. For example, light machine-building plants require 5-15 hectares for their accommodation. Even with a total compensation of R10,000 per hectare, its magnitude would amount to R50,000-150,000, with an estimated cost of the enterprises of R10-20 million and more. In the cities the compensation is the equivalent of 0.5-5 percent of the cost of development of the territories.
3. The limited nature of land resources urgently demands the implementation of measures for the recultivation of territories and the use of unsuitable and barely suitable land, despite the expenditure connected with these. According to data of the Central Scientific Research and Planning Institute for City Designing and Building, capital expenditure on removing the consequences of mining operations constitutes (thousands of rubles per hectare): 10-40 on the restoration of troughs, 100 and more on removing and landscaping dumps and 10-40 on filling in quarries; up to 13 on leveling out dumps of stripped rocks; and from 1.3 to 200 on the recultivation of urban territories.
4. There are proposals on the need to increase this indicator to 0.15. It is interesting in this connection to quote the following from Academician T. S. Khachaturov: "Some people believe that, having raised the efficiency norm from 12 to 15 percent, we will thereby increase the level of efficiency in the economy. But if matters are so simple, why not raise the norm to 20-25-30 percent, perhaps this would be better" (see METODY I PRAKTIKA OPREDELENIYA EFFEKTIVNOSTI KAPITAL'NYKH VLOZHENIY Izdatel'stvo Nauka, No 28, 1977, p 29). According to T. S. Khachaturov's calculations, the time needed to recoup capital investments thanks to the savings from a reduction in production costs in 1977 was approximately 25 years in industry, while recoupment is not achieved in agriculture and transportation (see VOPROSY EKONOMIKI No 7, 1979, p 124).
5. It is interesting to point out that in instances of the detachment of forest areas under the conditions of the Moscow region the amount of compensation is R6,000 per hectare of forest. But even this fails to prevent the occupation of this land.
6. K. Marx pointed out that even the worst areas with respect to fertility and location yield a differential rent (See K. Marx and F. Engels, "Soch." [Works], vol 25, pt II, p 295).
7. For example, in a number of oblasts of the Central economic region associated with the Volga basin the amount of adduced expenditure per cubic meter of water fluctuates within the limits of 0.101-0.333 kopecks (data of the All-Union Scientific Research Institute of the Economics of the Management of Water Resources for 1975).

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8. Despite the appreciable expenditure, this measure is extremely necessary: 1 cubic meter of "conditionally" clean and incompletely purified effluent pollutes 50-60 cubic meters of clear water and requires a 7-15-fold dilution with natural water for natural purification. Return water makes it possible to reduce the loss of valuable materials entering the water. The time required to recoup capital investments in the construction of purification installations does not exceed 5 years.
9. See EKONOMICHESKAYA GAZETA No 5, 1980, p 15.
10. K. Marx and F. Engels, "Works," vol 25, pt I, p 91.
11. State committees for nature conservation have already been set up in a number of union republics, and the Ministry of Forestry and Nature Conservation has been created in the Estonian SSR.

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INTRODUCTION OF NEW TECHNOLOGY

EFFECTIVENESS OF NEW TECHNOLOGY SCRUTINIZED

Moscow VOPROSY EKONOMIKI in Russian No 6, Jun 80 pp 44-55

[Article by D. Palterovich: "Actual Effectiveness of New Technology"]

[Text] Costs for implementing measures on new technology in industry make up a significant share of all state and enterprise expenses on scientific and technical progress and are growing somewhat more rapidly than outlays for science. To a certain extent, this trend reflects the focus of efforts on practical realization of scientific and technical achievements. In 1978, these outlays were 8.7 billion rubles, or 19 percent of total capital investment in industry, but in relation to capital investment just in machines and equipment for operating enterprises--about 60 percent. This figure includes outlays for new equipment installed during reconstruction, expansion, technical improvement and reequipment of operating enterprises, financed through centralized sources, funds for development and assimilation of new technology, as well as bank credit. Thus, the main share of these outlays is associated with setting up and installing equipment.

At the same time, there is insufficient utilization of the growth potential in effectiveness of these outlays. In 1978, 675,000 measures, differing sharply in nature and scope, were implemented in industry for new technology--from a major industrial process, a control system or automatic line costing hundreds of thousands of rubles to modernization of an individual machine tool or devising an attachment costing several hundreds or tens of rubles. In quantity, minor measures make up the main, but in cost--a small share of the total aggregate of measures. One should also consider that a considerable portion of the items introduced is characterized by only relative (for the given enterprise) innovation, while some of them in general are not new.

The amount invested, stated above, for measures on new technology in industry includes the amount spent in past years for new equipment installed in 1978, but does not include that year's investment, about the same amount, for measures which entail installation after 1978. The total outlays for measures introduced, including those of past years, exceed the given year's investment for the same group of measures an average of 1.6-1.7-fold.

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Table 1 Expenditures for introduction of measures on new technology in industry and their economic effectiveness (Based on data in the statistical annual, "USSR National Economy in 1978." Izdatel'stvo "Statistika", 1979, p. 94)	1975 as a		1978 as a		1978 as a		average annual	
	1970	1975	1978	% of 1970	% of 1975	% of 1978	1975	1976 - 1978
Number of measures introduced (thousands)	423	621	675	146.8	108.6	159.6	8.00	2.80
Actual outlays for introduction of measures, including outlays of prior years (millions of rubles)	5011	7518	8660	150.0	115.2	172.8	8.45	4.85
Number of workers freed relatively (thousands)	399	576	558	144.4	96.9	139.8	7.65	-1.05
Added profit from introduction of measures on the account for a year (millions of rubles)	1971	2828	2959	143.5	104.6	150.1	7.50	1.50
Annual economic effect from introduction of new technology (millions of rubles)	2607	3832	4340	147.0	113.3	166.5	8.00	4.25
Average actual expense per measure (thousands of rubles)	11.85	12.11	12.82	102.2	105.9	108.2	0.45	1.95
Average pay-off period through annual savings (years)	1.92	1.96	2.04	102.1	104.1	106.3	0.40	1.35
Average pay-off period through added profit	2.54	2.66	2.93	104.7	110.0	115.4	0.90	3.25
Average cost of relative release of one worker (thousands of rubles)	12.56	13.05	15.52	103.9	118.9	123.6	0.75	5.95
Annual economic effect as a percentage of added profit	132.3	135.5	146.7					

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Based on a uniform distribution of expenses over time during the period of realization of the measures, 1.6-1.7 year is the average time of implementation of a measure. In the process, it is a question of outlays for introduction into production of measures which to a considerable extent by their results determine the effectiveness of all outlays for development of science and technology.

Analysis of the dynamics of the basic indicators of the measures on new technology implemented in industry (table 1) shows that the rapid growth in outlays was accompanied by a significant growth in the number of measures introduced. The small increase in the average cost of one measure (8.2 percent in 8 years) can be explained by the change in prices for the means of production. Actually, the averages for the measures are not increasing.

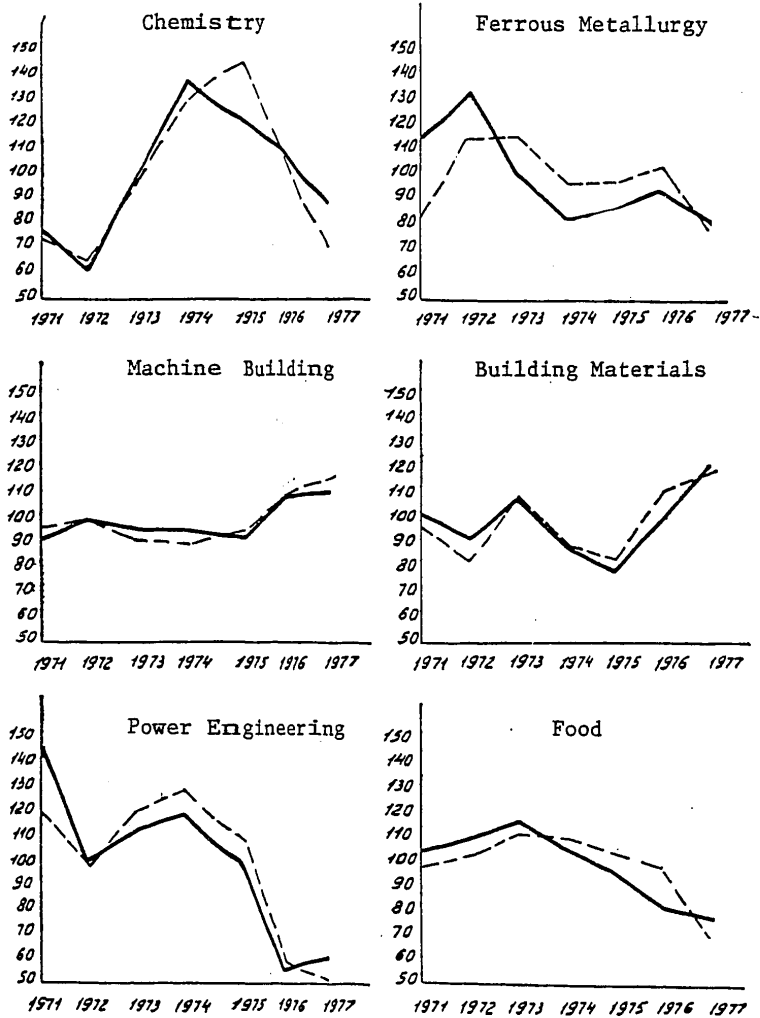
As outlays for measures on new technology have increased, the annual economic impact has grown almost to the same extent, the added profit from introduction has grown somewhat less, and the number of relatively released workers--still lesser.¹ As a result, average pay-off periods for expenditures on the introduction of measures on new technology have increased insignificantly. The average cost per worker released has grown 23.6 percent during the eight-year period; in our view, this is mostly due to two reasons: insufficient intensive introduction of effective technology in ancillary production (where expenses per worker released are considerably less than in basic production) and the relative (compared to growth in productivity) rise in price of many means of mechanization.

It is clear from table 1 that appreciable growth in outlays for measures on new technology was achieved mainly in the Ninth Five-Year Plan. The average annual growth rates for these outlays have declined considerably in the early years of the Tenth Five-Year Plan. This is evidently associated with the general slowdown in growth of production and profit in industry. Although about 12 percent of all profit is now allocated for introduction of new technology, compared to about 9 percent at the start of the seventies, the slowdown in growth rates for industrial outlays on new technology is not conducive to quick realization of the achievements of scientific and technical progress. On the average, outlays for introduction of measures on new technology for the national economy are very effective: they are recovered through annual savings within about two years, and through added profit in less than three years.² In the process, although the share of added profit from introduction of measures on new technology did increase in the total of all profit in industry (from 3.5 percent in 1970 to 4.2 percent in 1978), it is not very large and should be increased.³

Growth in the effect from measures on new technology cannot always be achieved by increasing the number of measures and money spent on introducing them. Moreover, analysis shows that a direct relationship does not always exist between expenditures for introduction and the effectiveness of the measures. Let us track this process in the basic sectors of industry (see graphs). To reduce the influence of price changes on amounts of

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outlays and results, let us take the change in the share of the sector in the overall total of outlays for measures on new technology in industry as an indicator of the dynamics of outlays by sectors; as an indicator of effectiveness, let us use the pay-off period through annual savings. In the process, the curve of the pay-off period in basic sectors of industry repeats the curve describing the dynamics of the outlays. In other words, a substantial growth in outlays for introduction of new technology in the sector is accompanied, as a rule, by an extension of the pay-off periods, i.e., by a reduction in the effectiveness of the measures.

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A similar trend is observable, though less clearly, in analyzing the dynamics of outlays and their effectiveness in the areas of scientific and technical progress. Thus, the sharp increase in outlays for automation of production during the period 1976 to 1977 was accompanied by an extension of the pay-off period for measures on automation from four to five years, i.e., to the highest level that occurred in any group of measures on new technology. A similar trend occurred in the period 1972 to 1974 for the group of measures on introduction of computer technology, and in 1976--for the group of measures on mechanization of production. At the same time, the decrease in the share of outlays for assimilation of new types of industrial production from 13.2 percent in 1972 to 9.2 percent in 1976 was accompanied by a reduction in the average periods of pay-off through the annual economic effect from 1.17 to 0.79 year.

A pronounced growth in outlays for measures on new technology in some sector or on a specific group of measures, as we see, is most often accompanied by a drop-off in effectiveness of these outlays, while a reduction or slowdown in the growth of outlays in the majority of cases is accompanied by an increase in the effectiveness. How can this situation be explained? Apparently, by the fact that with a rapid growth in number of measures, potential is not preliminarily expanded, the most effective innovations are not selected, and adequate steps are not taken to enhance the effectiveness of individual engineering solutions. Therefore, a sharp increase in the scales of introduction of new technology leads to a reduction in the requirements for effectiveness. As a result, the share of less effective measures grows and the average pay-off periods are extended. Thus, the rise in the percentage of measures on new technology in machine building in recent years (see graphs) and the extension of their pay-off periods can be explained by the substantial growth in outlays for equipment with lengthy pay-off periods. Just from 1975 through 1977 in machine building and metal working, the number of automatic lines increased by 2,349, and that of fully mechanized and automated sections, shops and plants, by 2,458. During the period 1975 to 1978, 25,600 machine tools with digital program control were manufactured, or 1.9-fold more than during the preceding four years. The pay-off periods for such types of equipment in the majority of cases are not less than four to six years, and not infrequently exceed the norms.

To eliminate the tendency of the effectiveness of new technology to decline as outlays for introduction of it are increased, a number of steps have to be taken. First, the work on forming the potential of effective technical innovations, prepared for introduction, should be improved. Solving this problem will require increasing the share of development funds in the total R&D investment, leading development of pilot plants, improvement in organization and stimulation of the processes of rationalization and invention, as well as adoption and transfer of scientific and technical innovations from some organizations and enterprises to others. Second, it is advisable to plan rates of growth of outlays for measures on new technology by sectors and directions of scientific and technical progress on the basis of an analysis of the available potential of the technical innovations, a

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comparison of indicators of their relative and absolute effectiveness with the norms, and a thorough consideration of resources.

A prerequisite of planned distribution of outlays by the most effective spheres of investment should be an analysis of the structure of the measures on new technology and their effectiveness by individual sectors and groups of measures (taking not only the economic effect into account, but also the social). This structure is complex and has many aspects; it has sector, technological and functional profiles. Measures, implemented in each sector or subsector, differ in their scales, target and technological directions, number of enterprises, where a particular innovation is introduced, etc. Exploiting data from existing statistical reporting (form 10-nt) permits construction of only some consolidated groupings.

The industrial structure of measures on new technology is characterized by the large share for machine building and metal working which in recent years has accounted for about 40 percent of all outlays, 50 percent of the annual economic effect and more than 44 percent of the profit from introduction of new technology in industry. The large share for machine building stems not only from the high relative significance of its products and industrial equipment, but also its significant technical potential, decisive role in the technical reequipment of all sectors of the economy, and short, compared to other industries, pay-off periods. The share for machine building in total industrial outlays for introduction during the period 1971 to 1977 grew from 32 to 39 percent, while that of the food industry declined from 10 to 7 percent; the portion for power engineering declined from 4.2 to 1.7 percent, and the share for chemistry, light industry, and the lumber, wood-working and cellulose-paper industry varied within the range of 6 to 10 percent. A more detailed analysis of the trends in scientific and technical progress and development of production capacity in each sector would be required to determine the regularity of these dynamics.

In the majority of the sectors, average pay-off periods through the annual economic effect tend to extend; however, this growth is not marked by constancy and uniformity. Thus, in the chemical industry, the average pay-off period extended from 1.56 year in 1971 to 1.99 year in 1973, but in 1977, it was shortened to 1.44 year, which was shorter than in the other industrial sectors. In machine building and metal working, the pay-off period varied insignificantly (within the range of 1.21 to 1.26 year) during the Ninth Five-Year Plan, but in 1977, it was 1.52 year. In light industry, this period extended systematically (from 1.53 year in 1971 to 2.32 years in 1977).

The longest average pay-off periods for measures on new technology are in power engineering, the extractive sectors, ferrous metallurgy, the lumber industry and the construction materials industry. However, in these sectors, analysis has shown, prolonged pay-off periods are not invariable and inevitable. For example, in 1977, these periods were sharply reduced in power engineering, petroleum processing and the food industry and were even

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Table 2 Change in the functional structure of outlays and annual economic effect of measures on new technology in USSR industry from 1971 through 1977 (as a percentage of the total)

Basic groups (areas) of measures on new technology	Outlays for measures on new technology				Annual economic effect				Added profit from introduction of measures calculating for a year
	1971	1973	1975	1977	1971	1973	1975	1977	
All measures introduced including:	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
introduction of advanced technology	41.9	41.5	42.8	39.3	41.8	39.7	40.5	40.5	48.7
mechanization of production	23.1	22.5	21.8	22.4	15.9	15.3	15.8	13.8	19.7
automation of production	9.1	9.3	9.9	12.6	4.9	4.6	4.9	5.0	6.1
introduction of computer technology	1.9	3.2	4.4	2.9	1.0	1.5	2.7	1.3	3.4
assimilation of new types of industrial products (first industrial series)	12.2	13.0	10.4	11.6	20.0	22.9	21.6	23.9	6.5
modernization of operating equipment	3.4	3.2	2.6	2.7	3.6	2.9	2.8	2.8	2.9
other measures	8.4	7.3	8.1	8.5	12.8	13.1	11.7	12.7	13.9

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shorter than the averages for all industry; at the same time, outlays for introduction in these industries were reduced substantially. Thus, although the pay-off periods for measures on new technology depend on the nature of the technology and the level of capital intensiveness of the industry, they can be shortened considerably when measures are selected more meticulously.

The average pay-off periods for measures on new technology are affected by many factors; of no little importance among them is the functional structure of the measures on new technology, constructed according to the basic directions of technical progress. The division, used in statistical reporting (Form 10-nt), of measures on new technology in industry into eight areas is very coarse: there is no identification, for example, of individual forms of automation and types of new technology. It is obvious that supplementing this form with more detailed classification of measures, as well as extending such a reporting form to other sectors of the national economy would expand the possibilities for analysis of the trends in scientific and technical progress.

In the existing structure of outlays (table 2), a high percentage is accounted for by measures on advanced technology (about 40 percent of all outlays and the annual economic effect, and about half of all profit from measures introduced in industry). In addition to measures on advanced technology, equality in percentages of outlays and economic effect is observed only in the relatively small group of measures on modernization of operating equipment. As for the economic effect from mechanization of production, its percentage is about two-thirds that of the outlays, from automation--one half to two-fifths, from introduction of computer technology--a little over half. Consequently, the pay-off periods for these groups of measures are considerably longer than average. Naturally, longer pay-off periods cannot be used as a basis for declining to introduce the means of automation or computer technology inasmuch as these measures are necessary, for example, to meet the needs for products or solve important social problems. However, this low effectiveness should indicate the necessity to choose meticulously and search for the most economic ways to realize a given group of measures.

The correlation of effectiveness of the different technological groups of measures varies greatly depending on whether cost accounting or national economic effect is used as the indicator in the accounts. The significance of selecting the effect indicator increases especially in connection with realization of the decree by the CPSU Central Committee and the USSR Council of Ministers, "On Improvement of Planning and Strengthening the Effect of the Economic Mechanism for Raising Production Efficiency and Quality of Work." The effect from carrying out scientific and technical measures, according to this decree, becomes a plan indicator, and a bonus for developing and introducing new equipment is awarded as a function of the total economic effect obtained in the national economy.

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Table 3 Dynamics of pay-off periods for outlays by areas of introduction of new technology and correlations of types of effect

	Period of pay-off through annual economic effect			Period of pay-off through profit calculating for a year			Profit as a % of savings from reduction of production costs in	Annual economic effect as a % of profit in	
	1971	1973	1975	1977	1971	1975			1977
All measures introduced including:	1.78	1.85	1.96	1.95	109.6	2.66	2.75	113.5	141.3
introduction of advanced technology	1.78	1.94	2.07	1.89	106.2	2.34	2.22	112.9	117.6
mechanization of production	2.59	2.74	2.72	3.17	122.4	2.93	3.39	108.5	107.1
automation of production	3.29	3.72	3.95	4.90	148.9	4.32	5.15	108.1	105.0
introduction of computer technology	3.22	3.86	3.17	4.29	133.2	3.50	4.25	116.3	98.2
assimilation of new types of industrial products	1.09	1.05	0.95	0.94	86.2	4.29	4.32	159.9	458.0
modernization of operating equipment	1.69	2.01	1.80	1.84	108.9	2.36	2.36	113.8	128.5
other measures	1.17	1.03	1.36	1.31	112.0	1.68	1.68	108.1	127.4

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The question of selecting the cost accounting or the national economic effect indicator is very complex and controversial. Having no claim on an unequivocal solution, we will try to approach it with regard to the actual correlation of the different types of economic effect by areas of scientific and technical progress. As seen from the data in table 3, in 1977, added profit exceeded savings from reduction in production cost in all groups of measures, except assimilation of new types of products, within a range from 8 to 16 percent. In other words, reduction in production cost produced the overwhelming share (84 to 92 percent) of profit in almost all groups, and only in assimilation of new types of products did this share decline to 62.6 percent, while the remaining 37.4 percent of added profit was obtained through an increase in the scale of production, a change in its structure, prices, etc.

More significant are the gaps between the amount of profit and the annual economic effect inasmuch as the latter is calculated as the algebraic sum of the annual economic effects derived by both the producer and the consumer of the new technology. This addition is performed in those cases when introduction of the new technology results in improvement of design, or an increase in productivity, durability of machines and equipment being produced, quality of raw materials or goods.

It is quite evident that the main portion of the annual economic effect, computed by the consumers, is derived from measures on assimilation of new types of industrial products. The sum of the annual economic effect of measures in this group exceeds the sum of profit from their introduction 4.6-fold. Almost one-fourth of the sum of the annual economic effect of all measures on new technology, introduced in industry, was accounted for by assimilation of new types of products. For this group of measures, the percentage of the annual economic effect is about double that of the outlays, while the percentage of added profit is half that of outlays. Consequently, the calculated pay-off periods for assimilation of new types of products through the annual economic effect are shorter than those for the other groups of measures, but the periods of pay-off through added profit are the longest, except for those for measures on automation. The annual economic effect appreciably exceeds the sum of profit also in the group of measures on modernization of operating equipment and in the group of measures on introduction of advanced technology. The consumer often derives an effect from the latter through improvement in the quality of products.

The manufacturer's accounting of the new technology consumer's annual economic effect undoubtedly leads to duplicate counting of it. New types of machines, equipment and materials, assimilated by manufacturers, are then used to introduce measures on advanced technology, mechanization and automation of production by the consumer. The effect, already accounted for by the manufacturer in planning measures on assimilation of new types of industrial products, is counted again by the consumer, but in more concrete amounts. Due to the lack of statistical data on the amount of the annual economic effect, calculated by the manufacturer and the consumer, it is not

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possible to determine precisely the sum of the duplicate counting of the annual economic effect of measures on new technology. In the order of the first approximation, it can be calculated as the difference between the annual effect and the profit of the measures on assimilation of new types of industrial products. In 1977, this difference in industry was 800 million rubles approximately, or almost 19 percent of the total annual effect. If the total value of the annual economic effect from all measures introduced in industry is reduced by this sum, it turns out to be only 15 percent more than the sum of the profit from introduction.

It should be noted that the indicators of the annual economic effect, especially in the part computed by the consumer, are less reliable than indicators of savings in production cost or profit. However, profit reflects only the cost accounting effect of a given enterprise, while the whole national economic effect is reflected more fully in the total value of the annual economic effect. In this connection, the periods of pay-off through profit to a large extent describe the gain from the measures for those enterprises that implement them, while the periods of pay-off through annual economic effect to a large extent reflect the effectiveness of the measures for the national economy. Take for example the measures on assimilation of new types of industrial products. Their high effectiveness for the national economy shows up in the shortest (less than a year), and also declining, average period of pay-off through the annual effect. But their inadequate gain for the assimilating enterprises is reflected in the lengthy average periods of pay-off through profit. As for the group of measures on introduction of advanced technology, their relatively short (compared to other groups) periods of pay-off through both the annual effect and profit are evidence of their advantageousness for both the enterprises introducing them and the national economy.

Based on the content and the quantitative relationship of the cost accounting and national economic effect indicators for measures on new technology, it is advisable, in our view, to utilize both profit and the annual economic effect for planning. But a differentiated approach is needed for the incentive program. Incentives for measures on assimilation of new types of products should be based on the annual economic effect, inasmuch as profit by the manufacturers makes up in this case only a small part of the national economic effect. For the other groups of measures, the amount of actual profit makes up, as a rule, the main part of the amount of the national economic effect; therefore, it can be used as a basis for incentives. In the process, the amounts of the incentive should, in our opinion, depend not only on the amount of profit, but also on its relationship to capital outlays, i.e., on the absolute effectiveness.

The sharp differences in levels of effectiveness of measures for the different sectors and areas of scientific and technical progress stem from both objective and subjective causes. Among the objective factors, one should include first of all the peculiarities of the technology of the different sectors and processes, and the substantial gaps in the level of the capital-output ratio of the industries. In this connection, we would like

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to come back to our suggestion on developing, along with a unified norm E_n , used in accounts of the relative effectiveness of capital investment, norms for overall or absolute effectiveness too.⁴ These norms, differentiated by sectors and areas of scientific and technical progress and developed on the basis of the experience of introducing effective measures on new technology by leading enterprises, would be references for use in choosing technical innovations for introduction.

The necessity of a differentiated approach to defining the threshold of effectiveness of the different areas of technical progress may be substantiated the following way. Let us assume that all innovations, the effectiveness of which is higher than the norm of 0.15, and that pay for themselves consequently within no more than 6.6 years, can be introduced. Does that mean that all of them should be introduced? Evidently, only when the potential of the available projects and proposals does not exceed the money and materials on hand. But in practice, this potential, as a rule, does exceed the resources on hand; therefore, all innovations can not be introduced. In choosing measures for introduction, it is necessary to consider not only the results of calculating their effectiveness (or pay-off periods), but also such factors as the role of the innovation in meeting quotas for increasing output of products, the duration of the effect of the measure, its role in saving labor resources, in improving working conditions, etc. With regard to these factors, in our view, recommendations should be worked out on establishing a minimum amount of effectiveness of the various areas of scientific and technical progress.

Such recommendations or even norms already exist in some methods materials on estimates of the effectiveness of individual types of new equipment. For example, for the outlays to introduce an automated control system, a minimum norm of effectiveness of 0.3 is recommended (to which corresponds the pay-off period of 3.3 years, i.e., half the period calculated for the norm of effectiveness of new technology). For manual machines used in assembly operations in machine building, it is suggested that a normative efficiency factor be maintained within the range of 0.5 to 1.0, corresponding to a pay-off period of one to two years, which should stimulate better utilization of machines by time.⁵ We agree with this, especially since electric and other manual machines as well as instruments have a standard service life of two years, and the common normative pay-off period of 6.6 years for new equipment can not be extended to them. The same applies to individual types of equipment for the mining, lumber, petroleum and electronic industries, agriculture, construction and some other sectors where part of the equipment has a standard service life of less than six years.

As indicators of overall or absolute effectiveness, it is advisable, in our opinion, to use the periods of pay-off through added profit, but for measures on assimilation of new types of products--periods of pay-off through the annual economic effect. However, the norms of overall effectiveness can become an important tool in choosing technical innovations for introduction only when there is sufficient potential of innovations in the

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enterprises. This potential is composed of in-house and adopted developments, projects, inventions, proposals by rationalizers, models of new products, etc. Adopted innovations should hold the largest place in the potential of technical innovations of each enterprise. After all, the engineering teams of one enterprise make up, as a rule, only a small part of the engineering teams in a sector. In many associations and enterprises, new industrial processes, means of automation and mechanization, and other engineering achievements are being developed and introduced at the same time which would be useful to extend to dozens, and sometimes hundreds of plants in a given industry and other industries with similar technology.

Meanwhile, innovations are not spread quickly enough. According to the data of a survey made in the Ukraine, the results of R&D, which is usually done by scientific research institutes and design bureaus, in 80 percent of the cases are introduced in one or two enterprises, and in only 0.6 percent of the cases is introduction made in five or more enterprises.⁶ The sphere of spreading technical innovations developed in enterprises is even narrower. Enterprises that are the first to develop and introduce an innovation have no right to obtain some sort of compensation for its transfer, and therefore are not interested in widespread propagation of their "creation," no matter how effective it would be for the national economy. Therefore, one of the main causes restraining dissemination of new equipment and technology is the lack of an incentive to an enterprise to transfer technical innovations to others.

Not infrequently, enterprises even resist transferring technical documentation for their innovations, inasmuch as they do not have an adequate number of duplicating machines, printing materials and specialists to fulfill such orders. The lack of interest in transferring technical innovations restrains their dissemination and causes great harm to the national economy. And the thing here is that not only do effective engineering achievements expand the sphere of their application slowly in the national economy, but also that enterprises expend resources searching for in-house engineering solutions that already exist in practice in industry.

Depriving enterprises of the right to receive compensation, apparently, stems from the desire to avoid, as it were, unfounded enrichment as a result of receiving payment from several or even many customers for technical innovation. Moreover, it is not quite clear how the amount of compensation should be determined: should prices of the technical innovation be based on outlays for its development and introduction or on the effect of its use? The complexity of the solution to this problem should not be exaggerated. Proceeding on the basis that the compensation should interest an enterprise, that has developed and introduced an innovation, in transferring and introducing it at the maximum possible number of other enterprises, it is not too difficult to construct an acceptable scale of compensation.

In our view, one solution would be to classify innovations by the scope of the possible sphere of their application: innovations that could be used

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at 2-3, 4-5, 6-10 enterprises, etc. For each group of innovations, a scale of payment for transfer should be established as a percentage of the added profit from introduction in such a way that with maximum expansion of the sphere of application of the innovation, the enterprise that first introduced it would receive, let us say, full compensation for its outlays or double the profit at the expense of the enterprises that had adopted this innovation. In the process, the amounts of bonuses for introduction of new technology should be increased in accordance with the increase in profit. Other methods for determining payment for innovations transferred are possible too. But under all conditions, reimbursed transfer of technical innovations, developed not only in scientific research institutions and design bureaus, but also in associations and enterprises, should become an integral part of the cost accounting system of organizing work on development, assimilation and introduction of new technology, provided for by the decree of the CPSU Central Committee and the USSR Council of Ministers, "On Improvement of Planning and Strengthening the Effect of the Economic Mechanism for Raising Production Efficiency and Quality of Work."

It is advisable as well to take steps to enhance the contribution of inventors and rationalizers in increasing the portfolio of new engineering projects and solutions. Statistics show that outlays for invention and rationalization are the most effective investments in scientific and technical progress. In 1978, 5.1 million inventions and proposals by rationalizers were submitted and 4.0 million introduced. Total outlays for invention and rationalization were 353 million rubles, but the savings from introduction, calculating for a year, were 5.878 billion rubles, i.e., for each ruble invested in invention and rationalization, 16.2 rubles were returned in savings from introduction. Rationalizers receive as compensation about six percent of the annual savings from introduction of their proposals, while inventors receive two percent of the savings from introduction of their inventions.

Also relatively small are the resources allocated for bonuses for promoting introduction (1.6 percent of the savings from introduction) and for mass organization measures associated with rationalization and invention (0.7 percent). Unfortunately, the form used for reporting invention and rationalization does not contain data on the outlays for introduction. Total outlays for rationalization and invention in industry in 1976 were only four percent of total outlays on introduction of measures on new technology, while the effect of the inventions and proposals by rationalizers introduced (calculating for a year) made up the main part of the economic effect of all measures on new technology. In other words, outlays for rationalization and invention are relatively small, but the introduction of measures based on inventions and proposals by rationalizers yields a significant share of the total effect. Hence, the conclusion is drawn that it is advisable to increase outlays for invention and rationalization, especially for compensation to originators and for promotion of introduction.

In our view, it is especially important to raise compensation for inventions, for the development and introduction of fundamentally new technology

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entails the greatest difficulties. In 1976, inventions introduced made up only 30 percent of the patents issued and another 35 percent were in the preparatory stage for introduction. At the same time, proposals by rationalizers introduced were 86.4 percent of the total accepted, and the remaining 13.6 percent were in the preparatory stage for introduction. A certain increase in outlays for invention and rationalization and strengthening of the incentive program for inventors would promote expansion of the potential of effective technical innovations.

To make better use of this potential and to rationalize the distribution of outlays for introduction, studies in all sectors of social production should be made of the effectiveness of measures introduced in profiles of technologically similar plants and areas of scientific and technical progress, and based on this, norms of overall effectiveness, as well as recommendations on criteria and the procedure for selecting measures on new technology for introduction should be developed.

FOOTNOTES

1. Due to the lack of accounting, indicators of effectiveness of measures on new technology are, as a rule, estimated. However, as noted earlier in the literature (see VOPROSY EKONOMIKI, No 7, 1974, p 139; and No 4, 1975, p 40), for the major groups of measures, deviations of the estimated indicators from the actual are counterbalanced, which makes it possible to use Form 10-nt data to analyze trends in dynamics and effectiveness of outlays on introduction of new technology.
2. Hidden behind the average pay-off periods are their significant differentiation by areas, enterprises and types of equipment. Thus, at the Minsk Tractor Plant, a mill for rolling transverse-helical semiaxles paid for itself within five months. Forklifts pay for themselves within six months on the average, semiautomatic multispindle rod lathes--with a year, specialized vertical drilling machines--within 2.7 years, specialized vertical lathe (turret) and milling machines--within 4.2 years, semiautomatic thread-cutting machines--within 6.4 years, and automatic machining lines--within 8.4 years (see G. A. Vasil'yev, "Ekonomicheskaya effektivnost' kompleksnoy avtomatizatsii proizvodstva" [Economic Effectiveness of Full Automation of Production], Izdatel'stvo "Ekonomika", 1978, pp 67, 68, 131, 146).
3. If one considers that each measure yields an effect over a number of years and the period of its "life" (based on the average machine model replacement frequency) is six years, it turns out that the overall share of profit, derived through measures on new technology, increased in industry during the period of 1970 to 1978 from about 21 to 25 percent.
4. See VOPROSY EKONOMIKI, No 4, 1975, p 48.

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- 5. See, for example, S. A. Yuzepchuk, "Tekhniko-ekonomicheskiye osnovy sborochnykh protsessov v mashinostroyenii" [Technical-Economic Bases of Assembly Processes in Machine Building], Izdatel'stvo "Mashinostroyeniye", 1977, p 222.
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- 6. See V. Pokrovskiy, "Raising the Effectiveness of the Utilization of Scientific and Technical Potential," (PLANOVOYE KHOZAYSTVO, No 3, 1977, pp 20-21).

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