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ECONOMIC AFFAIRS

(FOUO 7/81)

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INVESTMENT, PRICES, BUDGET AND FINANCE

SOVIET ECONOMIC POTENTIAL WEIGHED

Moscow VOPROSY EKONOMIKI in Russian No 2, Feb 81 pp 88-98

[Article by V. Krasovskiy: "Economic Potential: Reserves and Yield"]

[Text] Our country is entering the '80s with a powerful economic and scientific-technical potential. Achieved gains in the field of economic and social development make it possible to solve even bigger tasks. The share of fixed capital amounts to 64 percent of the national wealth. At the beginning of 1980 it equaled 1.6 trillion rubles, that is, it had grown by one trillion rubles since 1965. This growth exceeded almost twofold the value of fixed capital created in the first half century of socialist construction. Of the total fixed capital, production fixed capital amounted to 1.1 trillion rubles. In the last 10 years, it has grown twofold. The constant renewal of operating fixed production capital constitutes one of the most important trends of investment policy.

The biggest volume of production fixed capital is concentrated in industry. In the beginning of 1980, it exceeded 500 billion rubles (almost 48 percent of all production fixed capital of the country). In four years of the 10th Five-Year Plan, industrial fixed capital was almost one-third renewed. Agricultural fixed production capital equaled 223 billion rubles (21 percent of the total amount). During 1976-1979, more than 39 percent of it was renewed. Transport and communications fixed capital amounted to 223 billion rubles. In this period there were put into operation 22,900 km of arterial gas pipelines and branches from them, 11,900 km of main oil pipelines and petroleum-product pipelines and 68,500 km of hard-surface motor roads.

Fixed production capital of construction and other sectors of material production has been significantly increased.¹

In the beginning of 1980, the value of nonproduction fixed capital exceeded 562 billion rubles and amounted to more than one-third of the country's fixed capital. With growth in the scale of production, there was also an increase in physical working capital--tools of labor, raw and other raw materials, semifinished products, fuel. At the present time, their share of the national wealth amounts to 18 percent.

In the plan of the CPSU Central Committee for the 26th congress "Basic Directions of Economic and Social Development of the USSR for 1981-1985 and for the Period to 1990" provision is made for a more rational use of production capacities, wider scale introduction of high-efficiency equipment and improvement of the structure and

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renewal of operating fixed capital. It is planned to implement measures for increasing return on investment in sectors of the national economy, associations and enterprises.

The Potential of Fixed Capital and its Role in Socialist Reproduction

Intensive use and renewal of fixed production capital provides for economic growth and contributes to the realization of the achievements of scientific-technical progress, growth of labor productivity and improvement of production conditions. Fixed production capital is concentrated at 17,516 industrial enterprises, at 47,000 sovkhoses and kolkhozes and in transport.

Fixed production capital serves as a material-technical base for the development of new sectors of industry. There has been created a sector of atomic machine building. The construction of atomic electric power stations, especially in the European part of the country, makes it possible to boost the share of atomic energy in the total volume of production of electric power and to provide for the satisfaction of power needs in regions that do not have their own fuel and power resources. The capital of the chemical industry is growing at a rapid rate; it is now capable of supplying agriculture with about 100 million tons of fertilizers, plant-protection agents and also feed supplements.

In the Marxist outline of reproduction, subdivision one, that is, means of production always had a leading place. Within the limits of one subdivision, special importance was attached to sectors producing the means of production, which V.I. Lenin considered as a most important group for the rate of development of the national economy. Lenin's reproduction tables contain comparisons of the dynamics of constant capital and social product.² In a polemic directed at P. Proudhon, K. Marx examined the long-term dynamics of economic indicators of Great Britain for 70 years (from 1770 to 1840) while taking account of the increased capacity of technical improvements and growth of the productive part of the country's population. As a result of the comparison, there was shown the tremendous importance of growth of capacity of the production apparatus, which manyfold exceeds the growth of labor resources. Whereas in the initial period, the productivity of technical improvements applied to productivity of manual labor in a ratio of 4:1, at the end of the period, that is, in 1840, this ratio was already 108:1.³

In the studies of Soviet economists in recent years, increasingly frequent use is made of labor measurements of fixed capital, which in some measure continue the trend in analysis of their comparative capacity reduced, as in the case of K. Marx, to a single dimension. Such measurements have been used in the works of Academician S. Strumlin, Ya. Kvasha, I. Doroshin, L. Nochevkina and others. In these studies, however, the measurements were restricted to the consideration of labor outlays on the manufacture of equipment but failed to determine the growing capacity of the new means of labor.

In the economic literature, there are works along a different direction. Thus, sometimes in assessing the contribution of fixed production capital to the results of social reproduction, they are, as it were, given a "null" value in the consideration that since they have already been created and do not require additional expenditures their contribution to production can be reduced to zero. In other studies, the contribution of capital is evaluated according to the share of amortization

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in the aggregate expenditures of production. In this case, the share participation of the capital does not exceed 5-6 percent and, naturally, does not reflect that role which the means of labor play in the forming of the social product in its physical form. Ratios were also proposed of 1:2.5, 1:2.8 and 1:28 where the 1:2.8 is the relative size of the contribution of fixed production capital and 1:2.5 characterizes the relative participation of labor resources. On the theoretical level, reference is made to the consideration not only of used means of labor, which are detected by the indicators of amortization, but also, which is the main thing, in the consideration of used fixed capital which, as pointed out by Marx, operates all its mass and all its capacity over an extended period. This mass of used capital is not shown by the indicators of amortization. In reality, the country has a capacity of not one-twentieth of the entire mass of capital, but utilizes annually in its full volume, that is, all 100 percent of it.

The postulated problem has a direct relation to the differentiation of the role of means of labor in the forming of the use value of the product and its value as proposed by Marx; he wrote "that the known factor of the labor process and the known means of production participate as a whole in the process of labor but only partially in the process of value formation. The difference between the process of labor and the process of formation of value is reflected here in their material factors in such a way that one and the same means of production as an element of the labor process is included entirely in the given process of production but as an element of the formation of value is included in parts."⁴ Thus, the true economic value of the potential of production capital is incomparably greater than is accounted by the shares of its amortization. The possibilities of this potential are extremely great, and they should in full measure be studied and determined.

Economic Growth and Intensification of the Use of Capital

Intensification of public production predetermines the all-round use of existing fixed production capital, especially existing production capital.

It is pointed out in the CPSU program that "in all sectors of the national economy it is necessary to improve and strictly adhere to scientifically valid progressive norms in the use of means of production. The party attaches primary importance to the boosting of effectiveness of capital investment, the selection of the most advantageous and economic directions of capital work, assurance of the biggest growth of production for every expended ruble of capital investment and reduction of the pay-off period of this investment."⁵

In the formation of progressive norms of return on investment, one should proceed from the tenets of Marxist theory to the effect that "with progress of science and technology, the place of old machines, tools, apparatus and the like is taken by new, more efficient and relatively cheaper ones compared to the amount of their work."⁶

Many economists consider the indicator of return on investment to be theoretically unfounded. It is noted in a number of cases that lower return on investment is inevitable in the course of technical progress and exhaustion of the best natural resources. A hypothesis is even presented of the cyclic movement of the indicator of return on investment, which supposedly lawfully falls during periods of structural changes and increasing developmental rates and, conversely, grows during stabilization of the rate and intensification of production.

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In this connection it is necessary to point out that during the '30s there was raised the question in the journal PUTI INDUSTRIALIZATSII (its responsible editor at the time was V.V. Kuybyshev) of the wrongness of M. Smit's conception which substantiated a modified "law" of the inevitability of reduced effectiveness, in particular, of return on investment in connection with growth of the organic makeup of the capital.⁷ This was explained by the predominant growth of subdivision one of public production: by analogy with the tendency toward reduction of the profit norm cited in "Capital," M. Smit attempted to formulate a "socialist law" of the fall in the volume of produced production in regard to used capital.

Such ideas connected with the study of the comparative dynamics of production and fixed capital are to be encountered even today. A number of economists do not distinguish requirements on increase of return on investment from fixed production capital and return on capital investment and interpret such requirements as non-Marxist and not corresponding to the basic laws of the political economy of socialism. But thinking that the indicators of return on investment are adopted from the theory of productivity of factors of production, they forget about their labor basis. At the same time, there exists a real labor basis for the indicator of return on investment.

Explaining the significance of economy of embodied labor, for example, in spinning production, K. Marx emphasized that "worktime resulting in material of labor and means of labor we may consider in exactly the same way as if it were simply spent on an earlier stage of the spinning process to that labor which was joined in the end to the form of spinning."⁸ Analyzing the process of increasing labor productivity, he formulates the concept of an aggregate productivity, that is, living and embodied labor and cites by way of example the coal industry. "Let us assume," he wrote, "that outlays of past labor have increased with the same output of coal miners. In this case the 'labor of the coal miners has not become less productive, but the aggregate labor spent on coal production (the labor of the coal miners plus past labor) has become less productive."⁹

Under present conditions, the tasks of raising the efficiency of embodied labor and better utilization of accumulated economic potential acquire still greater significance. Indicators of return on investment should be considered first of all from the positions of labor productivity in capital creating sectors. It is required from the workers of these sectors that they produce production with the least outlays of labor per unit of useful effect and unit of capacity of machinery, units, production lines and the like. At the same time, workers of the construction industry have to achieve an economy of expenditures on the production of elements of buildings and structures, ensuring a reduction of their estimated cost since progressive and economic means of labor contribute to raising labor productivity and production efficiency in all sectors of the national economy connected with renewal of capital.

Technical Progress and Reserves for Raising of Return on Investment

In retrospect, the USSR economy showed a favorable correlation of indicators of capital and production. In 1978 compared to 1913, gross social product had increased 65-fold, national income--71-fold and production fixed capital of all the sectors of the national economy--37-fold. In the 60 years, the gross social product increased 57-fold, national income--68-fold and production fixed capital--

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34-fold. At the same time, from 1940 to 1978 and toward the end of the '70s, capital dynamics significantly exceed the movement of production. By 1978, compared to 1970, the social product had increased 56 percent, national income--53 percent and production fixed capital--89 percent, that is, return on investment had decreased 17.5 percent.

Reserves for increase of return on investment are connected both with processes of reproduction of fixed capital and with the character of load, intensive utilization and planned renewal of already operating capital and capacities. In the process of reproduction of capital, the need arises for proper organization of vast investment programs brought into existence by changes in the geographic distribution of material production and the creation of new centers of the extractive industry, including the fuel and power complex and the metallurgical industry. Most of these programs are being implemented in the east and north of the country, which is to be explained by the presence there of raw-material and fuel resources.

But this tremendous and it would seem extremely capital intensive sector of reproduction of capital possesses significant reserves for increasing yield and attaining high indicators of efficiency. It is essential to overcome the notion of Siberia being a region distinguished by great increase in the cost of capital and capacities, construction work, transport and other elements of economic potential. Enterprises of the eastern regions have the possibility along many directions of achieving leading indicators of return on investment and efficiency. Hydroelectric power stations, built on rapid rivers abounding in waters, in narrow cliff canyons, are characterized by extremely cheap electric power and extremely small losses from flooding. At coal cuts, the merits of open-pit mining are taken advantage of; machines are used which cannot be employed for underground mining operations. Enterprises of nonferrous metallurgy are located at deposits with a high content of useful components, which makes them more profitable than their western counterparts.

The concentration of natural wealth makes it possible to erect in the eastern part of the country tremendous enterprises with units of unique capacity and to employ the most modern equipment. Thus, at the Kansk-Achinsk coal basin in Krasnoyarskiy Kray, the Berezovskiy location is being established with a capacity of 55 million tons. Here there will operate electric power stations of tremendous capacity--6.4 megawatts, with an individual capacity of turbines amounting to 800,000 kilowatts and with cheapest electric power. Very large capacities are being also introduced at timber-industry complexes, ore-concentration combines, at aluminum plants and so on.

The high effectiveness of capital investment in Siberia is shown by data of Academician A. Aganbegyan. Thus, at the West-Siberian Petroleum-Gas Complex, there were obtained from the depths during the 10th Five-Year Plan 1.7 billion tons of hydrocarbon raw material (computed as petroleum). Taking into account only the efficiency of utilization of hydrocarbons in industry, the aggregate effect for the national economy from development of petroleum and gas resources of Western Siberia will be greatly above expended outlays. We know that production of Kuzbass coal is distinguished by lower relative capital investment and production cost than the coking coals of the Donbass and other basins and that their use is economically advantageous even for the central regions of the country. At the Tobol'sk Petrochemical Complex, the individual capacity of units will be two- to threefold higher than at the largest petrochemical Nizhne-Kamsk combine with higher labor productivity

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and lower production cost. The production potential of the Noril'sk Ore Mining and Metallurgical Combine and the high content of minerals in the extracted ores provide the possibility for this enterprise, despite the difficult natural conditions of the Arctic and the lack of communication with bases of material-technical supply for eight of the wintry months, of ensuring high technical-economic indicators.

The opening up of pioneer regions in Siberia and the Far East is bringing on the need of searching for new solutions in the field of technology of production, transport, infrastructure and so on. Attempts at a mechanical use of the regular methods adopted in the western regions of the country frequently lead to large losses.

Advanced experience shows that a number of innovative proposals practically implemented in Siberia call for further dissemination. We know that in the next 10 years the chief growth in oil and gas production and the chemical raw materials produced from them will take place among the deposits of Siberia. In this connection the volume of all work will have to be increased two- to threefold. In Tyumenskaya Oblast, it will be necessary to drill thousands of wells and to cut through 21 million meters of rock, that is, almost as many as in all the rest of the petroleum production regions. Roads will have to be laid to each Siberian drilling site, which is extremely difficult in the swampy morasses of the Western-Siberian lowland. Transportation costs in this region are roughly fourfold those in the European part of the country. In the immediate years ahead, when they will start to develop deposits that are more isolated than at the present time and with smaller holdings, the problem of transportation and good roads will become even more acute. At the same time, the road-building organizations of Tyumenskaya Oblast can lay only 100-120 km of roads a year, which is obviously inadequate when you consider the tempo of development.

In this connection, the use of platforms on an air cushion is promising. Platforms with a carrying capacity of up to 60 tons have operated in all seasons of the year with temperatures varying from plus 25 to minus 45 degrees; they have "hovered" over roadless terrain, overcome water barriers, growths of shrubbery, precipitous banks with ledges of up to a meter, as well as canals, gullies, mounds and even rivers at the time of ice flows. Transportation by them of sets of equipment and materials has made it possible to cut down the time of building drill sites by 4-6 months. But these platforms are being built only at the Tyumen' shipbuilding yard, and in limited quantities. Unfortunately, scientific and planning organizations, developing this form of transport, operate disconnectedly and have no ties with industrial enterprises.

Other directions in rationalization and cutting down of the cost of creating new capital in the east of the country include an organization in Tyumen' for the fabrication of complete sets of equipment and another in Krasnoyarsk for the flow production of industrial buildings made from prefabricated elements and light components for delivery of gas-pumping and petroleum-pumping stations to fields for the purpose of developing oil and gas deposits. The dimensions of this equipment are calculated in terms of sizes of railroad cars and vessels which are to transport them to the place of installation. They match in weight lifting equipment that is to be found at loading and unloading points. Unfortunately, the Tyumen' experience shows little adoption in other regions of Eastern Siberia and the Far East that are being newly opened up.

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There are, however, many unsolved problems as well as questions that have been incorrectly resolved. Thus, in the West-Siberian petroleum and gas complex, the basic construction material is ferroconcrete, although in Tyumenskaya Oblast in particular, which is distinguished by its lack of roads, swampy territories and weak ground foundations, tremendous difficulties occur in the use and delivery of heavy reinforced-concrete components. Timber traditionally for Siberia is used inadequately.

Load and Renewal of Existing Capital

The load and full utilization of production capital constitute a most important condition for the increase of return on investment. A most intensive load now characterizes the sectors of transport and electric power, which are operating continuously, and maximally operating mainline railroads, petroleum pipelines, gas pipelines and electric-power lines and the capacities of electric power stations. Further in the degree of load are production facilities utilizing continuous process and multi-shift work in the metallurgical and chemical industry, certain sectors of light industry and so on. Poorer use is made of production capacities in sectors of the investment complex, marked by one-shift work, and even this shift frequently does not carry a full load. The lowest loads are to be found in sectors of the agroindustrial complex, where in connection with seasonal variations, it is impossible to use a large part of the equipment during the wintertime. The last-named group would include certain sectors of industry and transport, particularly peat working, timber logging, river transport and so on.

The diversity of forms and types of products, as well as of methods adopted in the different sectors for the computation of production capacity, hinders the use of single-type indicators, capable of providing an integrated evaluation of the use of the potential of fixed production capital in solitary indexes.

There have been proposed in economic studies comprehensive power indicators based on the registration of the readings of time counters of the operation of electric motors operating with various equipment. A most substantive validation of such a method is contained in a book by Ya. Kvasha called "Reservnyye moshchnosti" [Reserve Capacities].¹⁰ He proposes a so-called capital-capacity [fondomoshchnostnoy] coefficient of the relation of production fixed capital (ϕ) to the motor power in kilowatts (H), subsequently computed for many sectors of industry with significant differentiation of coefficients. For example, while the number of hours of operation of electric motors in the chemical industry has been expressed by the indicator as 4,230, the potential time of use of machines due to the special features of the technology of machine building naturally would have been less than in the chemical industry and amounted to 1,260-1,500 percent.

Similar computations were made at the Moscow Plant imeni Vladimir Il'ich. The average time of use of electric motors produced by the plant and used with production capital amounts to 1,450 hours, although there is a possibility of boosting this time to 4,000 hours, that is by a factor of 2.7. Such global calculations require careful verification for sectors, although they nonetheless show the size of potential reserves for increasing the capacity of capital.

Some sectors of material production have their own specific reserves for boosting the yield of capital. Thus, in the extractive sectors with an aggregate production

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of minerals in excess of 6.5 billion tons, the size of losses amounts to 2.5 billion tons, including a fully disposable 500 million tons for the sum of 5-7 billion rubles. New methods of recovery, such as bacterial leaching, offer the possibility of working deep or already-worked deposits and terraces with greater effectiveness and sharply reducing areas occupied by mining enterprises. At the same time, this eliminates the need for the creation of shafts. There also become superfluous such labor-intensive operations as transportation, crushing and smelting of ore.

At the Novokrivorozhskiy Ore Mining and Smelting Combine there is in operation an installation for self-pulverizing of iron ores in a jet of water. Each hour the unit transforms about 100 tons of ore into small pebbles and powder. In pulverization of pieces of ore in a jet of water, there is no need of expensive steel for rods and cores, nor is there a need for cumbersome and power-intensive units for medium and small crushing. The process is fully automated.

Large reserves for increasing production output are connected to better use of irrigated and drained lands. Fixed production capital for land-improvement use is valued at approximately 75 billion rubles. But plan indicators reflect primarily data for start-up of capacities but not the results of reclaimed land. At the same time, they frequently go out of order because no work is done on maintenance of the drainage capability of drainage canals or on dealing with clogging or choking with undergrowth and the like. Therefore the main reserve for boosting of economic yield of water resources is to be found in yearly planning of the use of reclaimed lands.

In industry, a most important reserve for increasing return on investment is the timely and regular renewal of the production apparatus.

In the plan of Basic Directions, it is proposed to "improve the use of production capacities and capital... While taking into account the special features of individual sectors and production facilities to employ progressive systems of organization of the repair of machinery and equipment, ensuring an expansion of the inter-repair period of their operation."

The accumulation in sectors of obsolete and worn out capital hinders improvement of economic indicators and binds large labor resources and also requires tremendous outlays on repairs conducted on a low technical basis. Over the course of many years, 1-2 percent of existing fixed capital has been renewed on an annual basis. Not more than 20 percent of the new equipment delivered to industry goes into the replacement of withdrawn tools of labor. At the same time, reequipment of existing enterprises and renewal of applied technology produce rapid and effective results. In the construction-materials industry, the introduction of a progressive method of thermal treatment of polished glass resulted in boosting labor productivity four-fold, reducing production cost by a factor of 2 and growth of return on investment of 46 percent. Explosion stamping boots labor productivity six-to sevenfold and ensures high quality of articles. The Patontsis/700 installation developed in the USSR for electron-ray welding of products of the motor-vehicle industry increases by a factor of 3 labor productivity and reduces by a factor of 2 the need for capital investment.¹²

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Problems of Replacement and Renewal of Capital

For a long time, the planning and financing of capital investment, as well as the use of amortization funds in sectors of the national economy and at enterprises have been marked by the regular diversion of considerable amortizations sums, including a part of capital-repair funds, for the needs of new construction and major modernization. Sometimes such a practice comes to be accepted as a rule that is characteristic not only of the early stages of economic development but also of the mature socialist economy. On the basis of such ideas, a number of economists consider it advisable to exclude amortization sums from costs of production, assuming that their use for the creation of new enterprises will provide there an additional effect. It was also proposed to discount amortization, counting on future income from its productive use.

There were developed in this direction material-technical supply, machine-building production output and capacities of construction organizations that are primarily oriented to the provision of new large investment programs and items. As a result, unfavorable conditions have been created for the regular renewal of fixed capital on a present-day technical basis. Rates of retirement, not exceeding 1.5-2.0 percent a year, are roughlyly one-half of what is needed on the basis of age and technical condition of the fixed capital. But even such obviously inadequate rates of capital retirement remain in practice unfulfilled, for which reason the basic means of maintaining the production apparatus are capital repairs and consequently the preservation of existing capital at the former technical level.

The chief reason hindering timely renewal and modernization of capital is the irregular and unreliable material-technical supply of this work. Let us also note inadequate reliability in the valuation of old and new capital, especially in connection with the fact that the former are included in statistical materials usually in terms of reduced values with a reduction in price for obsolescence, and new equipment--on the basis of higher prices, which sometimes are not proportional compared to growth of capacity and technical characteristics of newly installed machinery. In a number of cases, the acquisition of such machinery is disadvantageous for enterprises and retards demand for new equipment.

For an extended period, the reinvestment process has been carried out primarily through repeated overhauls and to a lesser degree through replacement with new equipment. Frequently higher efficiency equipment has been sent to new enterprises, while equipment for existing plants in many cases was indistinguishable from that being replaced in terms of productivity and norms of servicing by workers. Such a character of the reinvestment process contributed to the encumbering of stocks of obsolete machines, which increased tension in the balance of labor resources and resulted in the operation of machines in shift systems.

Mention has already been made in the economic literature of the desire to gradually carry out the withdrawal of obsolete machines, transferring higher efficiency machines--stand-by machines for 3-shift work for the purpose of avoiding the use of additional workers. Naturally, in this connection not only should the operational regime of existing enterprises be changed but also the manufacture of higher efficiency equipment, especially automatic equipment, should be continually increased.

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Proposals have also been made to shift completely at the expense of amortization deductions for capital repairs to the purchase of new equipment for the replacement of obsolete equipment, but this would first require appropriate reorganization of all machine building in connection with the need of providing for a growing demand for the reequipment of existing fixed capital.

It would appear that systematic curtailment of capital repairs and equalizing of the correlations between outlays for the restoration of the original properties of worn out equipment and outlays for the production of new machines with progressive technical parameters should be carried out only in parallel with the reorganization of investment machine building. The gradual reduction of capital repairs is necessary, but it can only be achieved under the condition that equipment balances provide for an expansion of its share in deliveries to replace obsolete and worn out means of labor.

The solution of the problem of replacement and modernization in the material sphere and nonproduction sectors is not unique. Rational recommendations for the most effective ways of capital renewal are impossible without taking into account their specific characteristics.

In apparatus-type sectors, where powerful units are used (in ferrous and nonferrous metallurgy, in the chemical, petrochemical and cement industry, in the pulp-and-paper sector and in other similar production operations), good results are achieved with the combining of two or three types of reproduction, for example, reconstruction and capital repair or modernization and capital repair when the resources and capacities of construction and repair organizations are simultaneously united.

For the purpose of obtaining a growth in steel they have carried out at many metallurgical enterprises in recent years the conversion of open-hearth furnaces into two-tank [dvukhvannye] furnaces. Especially rich experience in such work has been acquired at the Magnitogorsk Combine where all the 560-ton open-hearth furnaces were rebuilt into two-tank furnaces. But all this reconstruction was done at the expense of the capital-repair fund. It has turned out to be effective, although it is inferior in its possibilities to perfectly new steel-smelting units. Reconstruction of enterprises is also combined in other sectors with capital repair and modernization of large units and apparatus (for example, in the chemical and petrochemical industry and the production of construction materials). In the cement industry, about 100 furnaces for the baking of hard-burnt brick have been modernized in the last 10 years. Their diameter was increased, cooler units were replaced, more advanced heat-exchange units were improved and put into operation. Labor productivity was boosted 20-25 percent. As a result of the repair and modernization of furnaces and mills as well as intensification of production processes, production capacities grew as a whole by 8 million tons, which is the equivalent of the capacities of four large plants. Specific capital investment for modernization, repair and reequipment of production amounted to 29 rubles per ton of cement; with the new construction it amounted to 38-42 rubles per ton.

For the petrochemical and petroleum-refining industry, characteristic enterprises have large-tonnage, consolidated and combined production installations. Stopping them separately for repair or modernization is not economical as this requires the simultaneous concentration of a large number of installation and repair personnel and appropriate equipment. Moreover, stoppages of large blocs are connected with

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losses of large amounts of products. In this connection, modernization and capital repairs are coordinated here in time. A selective analysis of the results of 415 capital-repair operations of production equipment of petroleum-refining plants showed that repair was combined with modernization in 222 cases (53 percent).

It should be kept in mind that construction work connected with capital repairs coincides with modernization and reequipment in apparatus sectors not only as to time but also as to the character and conditions of work and organization of material and technical supply.

A different reinvestment situation has come about in construction and agriculture. Despite all the difference in technology and organization of production, they have a certain similarity in the use of comparatively uniform machines and mechanisms, difficult operational conditions, the need to take into consideration seasons and climatic conditions, the comparative rapid wear of equipment, which frequently falls short of normal periods of use and, finally, in an excessive development of its own, far from always effective, repair service.

More than 300 repair plants and about 2,000 specialized repair shops operate in the country for the repair of agricultural equipment. At the same time, the concentration level at Goskomsel'khoztekhnika plants is one-fifteenth and in shops for the repair of tractors one-two hundredths that of the level of concentration in motor-building and tractor plants of the Ministry of Tractor and Agricultural Machine Building. As a result of the low equipment load, production output per square meter of production areas at specialized enterprises of Sel'khoztekhnika is one-quarter that of the tractor plants of the Ministry of Tractor and Agricultural Machine Building and one half that of integrated-unit plants of the same ministry.

The return on investment at the specialized repair shops of Sel'khoztekhnika is 30 percent lower and labor productivity two-thirds that at tractor plants. The equipment shift coefficient at repair enterprises of Sel'khoztekhnika is equal to 1.1-1.2, while the coefficient of intrashift use of equipment is 0.4-0.5, and they are, respectively, 1.6-1.8 and 0.88-0.9 at plants of the Ministry of Tractor and Agricultural Machine Building.

According to calculations of scientists at the Department of Mechanization and Electrification of the All-Union Academy of Agricultural Sciences, it would be economically practicable to have, instead of the existing 2,000 specialized repair plants and shops under Soyuzsel'khoztekhnika, 150-200 enterprises in the national economy performing repairs on the basis of large-series industrial production. In the future, the network of large repair enterprises could be fused into a network of plants fabricating new machines. Then repair and restoration would require only basic parts and possibly only certain expensive component elements. As a whole, a transition will be made to the so-called "firm" repair of agricultural machine building.

The plan "Basic Directions" provides for the implementation of measures aimed at boosting return on investment in the national economy and in sectors, associations and at enterprises. Large reserves for increasing the yield of capital have to be mobilized through the rational use of production capacities, wide-scale introduction

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of high-efficiency equipment, improvement of the structure and timely renewal of equipment. Special attention must be devoted to the need for reducing the time of full use of projected capacities at newly started enterprises and facilities and for increasing the work shift coefficient, rapid replacement of obsolete equipment and reduction of proportionate capital investment.

FOOTNOTES

1. L. Volodarskiy, "National Wealth of the USSR" (EKONOMICHESKAYA GAZETA, No 50, 1980).
2. "Leninskiy sbornik XXXVIII" [Lenin Collection 38]. Moscow, Politizdat, 1975, p 90.
3. See K. Marx and F. Engels, "Sochineniya" [Works], Vol 4, pp 124-125.
4. Ibidem, Vol 23, pp 215-216.
5. "Programma Kommunisticheskoy partii Sovetskogo Soyuza" [Program of the Communist Party of the Soviet Union]. Izdatel'stvo politicheskoy literatury, 1962.
6. K. Marx and F. Engels, op cit, Vol 23, p 619.
7. See PROBLEMY EKONOMIKI, No 2, 1930, pp 11-13.
8. K. Marx and F. Engels, op cit, Vol 23, p 199.
9. Ibidem, Vol 26, Part 1, p 177.
10. A. Aganbegyan, "Economic Problems of Development of Siberia (EKONOMIKA I MATEMATICHESKIYE METODY, No 5, 1979, pp 844-845).
- *10. See Ya. Kvasha, "Rezervnyye mozhchnosti" [Reserve Capacities]. Izdatel'stvo "Nauka", 1971, p 106.
12. See G. Danilin, "The Specific Features of Nonmechanical Forms of Technology (VOPROSY EKONOMIKI, No 8, 1979).

*Translator's note. The number 10 appears twice in the original text.

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INTRODUCTION OF NEW TECHNOLOGY

GATOVSKIY EXAMINES INCENTIVES FOR TECHNICAL PROGRESS

Moscow VOPROSY EKONOMIKI in Russian No 2, Feb 81 pp 64-74

[Article by L. Gatovskiy, corresponding member of the USSR Academy of Sciences: "Economic Stimuli of Scientific-Technical Progress"]

[Text] In the implementation of the plan of the CPSU Central Committee for the 26th party congress "Basic Directions of the USSR Economic and Social Development for 1981-1985 and the Period to 1990," a significant role belongs to effective use of a complex of economic stimuli aimed at acceleration of scientific-technical progress and growth of its effectiveness. A basic problem here is to have the increase in requirements--with account being taken of world development--from the direction of society on production and science in regard to the rate and effectiveness of scientific-technical progress (through economic and scientific policy, plans, programs and norms) organically combined with the increase in the interest and initiative of enterprises and their collectives, associations, regional organs, ministries and scientific institutes in the realization of these rapidly growing national economic requirements.

Economic stimuli emerge as a necessary means for the effective realization of developmental plans of public production, including scientific-technical progress. At the same time, a plan and its fulfillment and evaluation of this fulfillment serve as a most important economic factor exerting a directing and thus a powerful stimulating influence on all operational activity. Here questions are examined relating to the comprehensive solution of a number of outstanding problems of stimulation of scientific-technical progress in the 11th Five-Year Plan on the basis of a decree of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Strengthening the Action of the Economic Mechanism on Raising Efficiency of Production and Quality of Work" of 12 July 1979, with consideration being given to normative acts adopted on its basis.

Orientation of Industry Toward Expansion and Effectiveness of Realization of the Achievements of Science and Technology

A necessary condition of the effectiveness of economic stimuli of scientific-technical progress is providing it with a direction in which temporary cost-accounting unprofitability, which up to now has been widespread, of learning to handle new high-efficiency equipment for the national economy yields its place to the advantages provided to enterprises and associations by the adoption of such equipment. Although much has been done in this direction, it still has not been sufficient for the solution of this major national-economic problem. A prerequisite of its

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during the period of its assimilation advanced funds from the ministry's neutralized cost-accounting common fund for the development of science and technology for full compensation of necessary higher outlays and losses from the temporary deterioration of indicators. When the new equipment becomes assimilated, enterprises (associations) producing and using it in fact through deductions (from the profit that has accumulated by that time) into the common fund basically return the funds obtained in the past; these will then be used as compensation for increased outlays and losses of the period of assimilation of the equipment which is now new. This to a certain extent is the credit principle of utilization of deductions from profits. In our opinion, bank loans guaranteed by a ministry should be increasingly included in this process.

In order to fully provide compensation for socially necessary increases in expenditures and losses of the period of assimilation of new equipment through the common fund (with consideration being given to the development of bank credit and, in special cases, the use of a budgetary source), we believe the following is required: first, a significant increase in the total size of the common fund for the development of science and technology through increased deductions from profits coming from previously assimilated equipment (which will be fully recovered through subsequent realization of the gains inherent in the new equipment); second, a large increase in the share of the common fund assigned by ministries for the assimilation of new equipment; third, changing of the mechanism of formation of the common fund: deductions of enterprises (associations) from profit during the period of assimilation of new equipment must be significantly reduced (differentiated according to years) and after assimilation increased with growth of their annual size.

Such is the nature of the mechanism of redistribution of profits from production operations that were earlier assimilated in favor of newly operating production operations. As a result of this, the present correlation of profits, which is extremely disadvantageous for enterprises and associations introducing new equipment and which slows down technical progress, will be eliminated. The transition to an economic mechanism, fully compensating socially necessary increased expenditures during the elimination period, will make it possible to ensure the attainment of normal profitability of production for enterprises (associations) undertaking series output of new equipment.

A most important condition of assuring full compensation of outlays relating to assimilation is the introduction (owing to a temporary increase in production labor-intensiveness) of the following procedure of compensation for increased outlays on wages during this period): establishment of wage norms according to years of each new product being put into production while taking into account the required temporary higher labor incentives during the assimilation period (the permission of which in certain cases is mentioned in the decree of 12 July 1979), with compensation from the common fund for the development of science and technology of the difference between the allowance inherent in the price and the allowances of the assimilation period being compensated from the common fund for the development of science and technology. Only such a way would open up real possibilities of compensation for the necessary higher outlays on wages and utilization of normative planning of wages for the purpose of stimulating scientific-technical progress. A source of such compensation (as in the case of all other increased outlays of assimilation) would be deductions into the common fund from profits accruing following assimilation of the equipment.

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solution, in our opinion, is the systematic inclusion in the economic mechanism of the law of dynamics of the economic effect of new equipment: it is usually not manifested at once but for the most part after learning how to use it. As a result, during the period of learning how to handle new equipment, economic indicators used in the evaluation of operation deteriorate temporarily and enterprises and associations producing and using it are provided incentives. This occurs despite the economic effect inherent in the new equipment, which is applicable to the entire period of its production and operation.

At present the covering of expenditures relating to mastery of operation are chiefly done for work connected with the fabrication and putting into operation of samples. It is planned to cover the cost of this work and to ensure their normal profitability. Another matter is the series production of new equipment being mastered. Industrial enterprises and associations receive on the average only a small share of the necessary funds for covering the higher expenditures connected with the development of series production of new equipment. Consequently, in a significant majority of cases, the putting into operation of series production of new equipment reduces profits or brings on losses. Frequently, the biggest profitability comes from long introduced equipment (for machine building in a number of cases this applies to items that have been produced for 10 or more years). Temporary deterioration of indicators is particularly strong with the establishment of essentially new equipment and other technical items of a high qualitative level. Since this pattern is at the present time still insufficiently taken into account in the planning and economic mechanism, the desire arises among enterprises and associations, as well as in ministries to frequently hold back introduction or employment of new equipment of high effectiveness for the national economy, which in a number of cases is substituted for by insignificant changes of low effectiveness of long developed equipment (reference is not made in the paragraph to special production operations).

Therefore, an important initial problem in the use of economic stimuli for scientific technical progress is to fully neutralize during the period of assimilation the influence of factors weakening the interest of enterprises and associations in producing and operating new high-efficiency equipment. Such a mechanism has so far not been established. We mean overcoming the negative effect of such factors: growth of production cost, of labor intensiveness, the capital-output ratio and the materials intensiveness of production, exceeding of the wage fund; drop in the growth rate (or an absolute reduction) of production volume and labor productivity; reduction of volume of profit (profitability) or appearance of losses; curtailment of the size of incentive funds. This, in our opinion, would require the solution of the following tasks: (a) to ensure full compensation of enterprises and associations (manufacturers and consumers) assimilating new equipment for socially necessary temporary raising of production expenditures; (b) to establish for this period plan assignment and norms at levels corresponding both to requirements for quality of work and to the realistic possibilities of the assimilation period; (c) fully to compensate for reductions in incentive funds arising not through the fault of the enterprises or associations.

The realization of the given tasks is possible given a condition where the sources for this will be obtained from scientific-technical progress itself, that is, from those additional funds that come with greater efficiency resulting from the qualitative and quantitative growth of production. On the strength of a future rise of efficiency of the equipment, which at the given time is only being assimilated, enterprises and associations ought to obtain (within the framework of the sector)

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To neutralize during the period of assimilation of new equipment the negative effect of reduction of production volume on motivation of enterprises for its output and use, it would be advantageous to establish (according to years of assimilation) planned targets for this indicator that take into account the specific features of the processes of undertaking a given type of product. It would be wrong for an unrealistic plan to be assigned for the production of products during the assimilation period, and an enterprise assimilating new equipment is punished, as it were, for the nonfulfillment of a boosted production plan. Such a "prospect" hinders the manufacture of new and efficient equipment.

In the decree of 12 July 1979 in some cases changes of established plans are permitted for the assimilation stage. For the development of this position, there should be adopted on the basis of different norms, in our opinion, differentiation of actual annual plans of production and use of equipment for different stages of its series production: (a) assimilation period, (b) during spread of equipment following assimilation stage. The effectiveness of this approach is fully confirmed by experience abroad. It is advisable to conduct this differentiation of assignments (on the basis of corresponding norms) and according to profit, labor productivity, labor intensiveness, capital-output ratio and materials intensiveness. Following the assimilation of efficient equipment, the temporary drop of indicators and norms will be significantly covered by their growth. The reduction of economic-incentive funds connected with the reduced production volume of new equipment during the assimilation period (and hence the reduced profits) will be fully compensated from the material-incentive fund and the common fund for the development of science and technology, which are centralized at the ministries.

The real provision of these measures requires the development of differentiated norms for each type of equipment (manufacturing processes) for the size of expenditures and assimilation time periods (by years), time of attaining planned technical and economic indicators, dynamics of the series form of production and formation and utilization of incentive funds. The norms exclude the possibility of using funds for compensation of assimilation funds for covering damage from work deficiencies and mismanagement. At the present time, the absence of such norms hinders compensation for increased assimilation expenditures because of the impossibility of the necessary validation of the actually required size of this compensation. Here planning of sales volume and profit size for the assimilation period and establishment of valid requirements of resource use for this period becomes complicated. In the fulfillment and overfulfillment of assimilation norms it is advisable to increase incentive sums and in the case of underfulfillment--to reduce them.

Moreover, the purpose of such norms is the reduction of presently existing excessively large expenditures and assimilation time periods in accordance with the task set in the plan "Basic Directions." The establishment of norms must obligatorily be accompanied by measures for cost reduction and acceleration of assimilation processes, including regulation of planning, financing and resource provision for timely preparation of production, wide-scale development of standardization of components, parts and manufacturing processes and its stimulation (reduction or elimination of bonuses for designers in the case of unjustified creation of "original" components of designs).

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But neutralization alone of the negative effect of processes of equipment assimilation on economic indicators is not enough for the effective stimulation of scientific and technical progress. It is also necessary to take into account other difficulties connected with assimilation processes hindering the transition to new efficient equipment. They include: insufficient reserve capacities (they have to be provided for in advance and included in the plan); imposition of technological discipline in the creation of new production operations; additional difficulties with material-technical supply and the establishment of new operational production ties with clients and suppliers; appearance of production risk; organizational obstacles (thus, the development of a regular standard design of a household refrigerator requires the coordination of more than 50 organizations and the collection of up to 150 signatures¹) and the like. Many of these difficulties can and must be overcome, for example, by means of priority resource supply during the assimilation period. But to a large degree, the added difficulties are inevitable for assimilation processes. They must be covered through the creation of advantages for enterprises and associations assimilating the new equipment primarily in two forms: (a) higher profitability (additional profit) and (b) increase of material incentives.

A source of formation of additional profit is growth of surplus product because of scientific-technical progress. For this additional profit for the manufacturer of new equipment, the growth of price increases established for the high quality of equipment is of special importance. At the present time, on the average for industry only a small part (about one-fifth) of the new technical products conforms to the requirements of the highest category of quality and receives a price increase; moreover, the size of the increases (which depend on their effect) are insignificant because of the low level of effectiveness of many produced new technical products. Thus, solution of the question of additional profit is held back because of an inadequate level of quality and effectiveness of the overwhelming mass of new equipment.

Under conditions where the higher expenditures and losses of the assimilation period of new equipment are compensated insignificantly, the increase in its price usually cannot make up for the absence of required compensation and thus bring about additional profit. Weak motivation persists in producing high quality new equipment that would provide the possibility of getting a markup. Thus, because of defects in the economic mechanism, the field of use of markups as a factor of acceleration of scientific-technical progress is artificially narrowed. The presently existing prevalence of the sum of markups applying to previously assimilated equipment compared to the relatively small sum of markups for new equipment reduces the interest of enterprises and associations in technical progress. To the extent that the question of neutralization of the negative effect of assimilation processes on economic indicators, incentives will grow significantly--with corresponding orientation of plans --for putting into production highly efficient equipment and correspondingly for obtaining price markups for it. Then the relative share of products of the highest category of quality and their markups will increase significantly in the total volume of new equipment being produced.

1. See N. Glushkov, "On Further Improving Planned Price Formation and Its Influence on Boosting Work Efficiency and Quality" (PLANOVoye Khozyaystvo, No 6, 1980, p 4).

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At the same time, in addition to the above-proposed measures for stimulating higher quality and efficiency of new equipment (which would result in the growth of higher prices obtained for it), a transition should gradually be made, in our opinion, to a procedure where, as a rule, only that equipment selected for production would be considered new which is on the level of the highest category of quality (including high efficiency) in the case of these requirements becoming more severe (concerning which mention is made below). Then the stimulating role of markups for quality will be even higher for scientific technical progress and the question of enterprises and associations adopting new efficient equipment obtaining considerable additional profit will be resolved.

For these ends, it should also be established that high-efficiency new equipment has a certain priority over earlier introduced equipment in regard to obtaining a Seal of Quality, markups and their sizes. It is at present established that a price addition can be granted for 4-5 years (for 1-2 years prior to awarding of the Seal of Quality and for 3-4 years after it has been awarded. This means that a price addition of the same size can be granted for new equipment and also for equipment that has not been new for a number of years. Furthermore, an extension of the price increase is permitted in the same size for another 1-3 years and in certain cases for 5 years given the condition of an improvement in technical-economic parameters. If the technical-economic indicators in this connection are not improved, then the Seal of Quality is still awarded, but the size of the price increase is halved.²

Such periods of operation of price increases, especially in the same size, we believe to be excessively long. Their size reduction should be carried out earlier--soon after the new equipment has been assimilated. This would make its assimilation more advantageous and accelerate the tempo of growth of production volume (for the purpose of utilizing the shorter periods of price increase). When extending the period of price increase, it would be advisable to leave untouched its former size only with significant modernization of technical products, bringing with them a growth in efficiency of 25-30 percent or more. With a lesser efficiency increase, the size of the price increase should be reduced on the basis of a corresponding scale to one-half or one-third. If the improvement in technical-economical indicators is lacking or is insignificant (less than 10 percent of growth in efficiency), it would not be advisable to either award the Seal of Quality or grant any sort of price increase. Such increased demands on periods of operation and price-increase size would stimulate acceleration of efficiency of technical renewal of production.

Another factor in the creation of advantages for enterprises and associations assimilating new efficient equipment is the implementation supplementing the decree of 12 July 1979 of a complex of measures for boosting personal material interests of personnel of enterprises, associations, ministries and departments in fulfilling plans for acceleration of economically effective technical progress. Such measures should be implemented solely on the basis of their effect on scientific-technical progress.

2. See "What is New in the Establishment of Incentive Price Increases" (EKONOMICHESKAYA GAZETA, No 48, 1980, n 8).

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Developers and other engineering and technical personnel, directly engaged in the creation, assimilation and use of new efficient equipment, should guarantee the receiving of a higher share of bonuses intended for this work. They frequently receive for new equipment much smaller bonuses than those personnel who in general are not connected with technical progress. As for bonuses for general results of operational activity, it would be advisable for personnel directly engaged in carrying out technical progress to have their material-incentive funds raised (roughly by 20-25 percent), after establishing the dependence of boosting bonuses on gains from developments, degree of participation and responsibility for performance of work on new equipment.

Those managerial personnel of associations and enterprises who are responsible for the fulfillment of tasks relating to technical progress now can receive large bonuses regardless of the state of affairs at enterprises in this field. The marginal sizes of bonuses namely for efficient new equipment have been reduced for these personnel. It would appear to be advisable to restore to managerial personnel of enterprises and associations responsible for the course of technical progress their former maximum limits of bonuses (payments twice a year) under the condition of achievement of high results in technical progress. At the same time, the fulfillment of plan targets for technical progress must become for them an obligatory condition of receiving bonuses for the results of operational activity. Workers engaged in pioneering learning of how to handle complex new equipment (both in its manufacture and use) should have instituted for them for this period additional pay in the form of increases to wage rates (of about 10 to 25 percent). The granting of bonuses to personnel of ministries and departments organizing fulfillment of targets for scientific-technical progress or participating directly in such developments should be introduced. The rewarding of these personnel can be done from centralized bonus funds for new equipment existing in ministries (departments).

Increasing the effectiveness of economic stimuli for scientific-technical progress should lead to the gradual overcoming of the "dual" approach to planning which is rather prevalent in operational practice: production plans are fulfilled and overfulfilled through the manufacture of previously introduced products and these plans are absolutely obligatory for fulfillment and result in profitability; plans for the assimilation of new equipment are, as it were, "unfounded," their fulfillment is frequently "not advantageous" and is not that obligatory. In a number of cases, with general fulfillment of plans relating to production, plans for new equipment (frequently considerably reduced in regard to its quality) are not fulfilled.

To raise the effectiveness of stimulation of scientific-technical progress, it is necessary that plans for new equipment do not stop with the creation of samples or first industrial series but encompass the entire period of assimilation of this equipment (as an object of special planning) up to the attainment of planned indicators, becoming an organic and most important part of the production plan bringing economic advantages to enterprises and associations. It is also important for tasks relating to scientific-technical progress in special goal programs and supply authorizations to include mass realization of end results by enterprises and associations and not be limited to first industrial series (as is frequently the case) but encompass all the stages of dissemination of the created equipment (on the basis of these targets) and its use according to spheres of employment. Programs and supply authorization should also provide priority resource provision for the development and dissemination of the new equipment at all stages. In long-term plans

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of technical development and special goal scientific-technical programs, it is important to provide without fail for the creation of reserve resources (including reserve capacities), which from the moment of their formation could be used for newly arising needs of scientific-technical progress.

In the planning of scientific-technical progress, the time periods of output of each model of new equipment and its service life should be precisely specified in planning of scientific-technical progress. Increased control (including by the USSR State Committee for Science and Technology and Gosstandart USSR) over adherence to these time periods will be an important factor in the timely renewal of production and production capital. In our opinion, extension of time for the production of a model after determination of the time of its replacement demands permission from the USSR State Committee for Science and Technology and Gosstandart on the basis of study or a valid proposal for such an extension by ministries. Then the USSR State Committee for Prices will refix the price for the model. This, in particular, is of particular importance to the forbidding of production of obsolete technical products that belong to the second category of quality of production and also for control over the establishment of price reductions for equipment belonging to this category. Such a procedure should also be established with respect to extension of the service life of models included in the stock of equipment.

In the stimulation of scientific-technical progress, the role of planning will grow significantly given the condition that plans and programs of technical development of sectors became integral and leading parts of sectorial production plans. We believe that it is advisable to carry out a gradual transition to common coordinated plans of technical development of sectors and of the capital investment required for this. One of the basic tasks of scientific-technical progress is, with increased use of economic stimuli, to bring machine building into accord with the requirements of reequipment of sectors. The main thing to be done here is not increasing the rate of capital investment in machine building but making significant changes in the directions and structure of capital investment in accordance with the real needs of a radical technical transformation of sectors on the basis of increasingly greater concentration of capital investment in production of equipment based on new technological principles or on a radical improvement of traditional principles. It would be advantageous to shift to the creation of joint programs which determine the coordinated development of machine-building production facilities and users of their products by spheres of their use and the employment of supply authorizations. Planning and stimulation of the creation of high-efficiency sectorial and also functional intersectorial systems of machines must become a most important element of plans (programs) of comprehensive reequipment of sectors.

The need for a significant rise in demands on machine building and strengthening of economic stimuli for its development are attested to in particular by such facts as the reduction for many enterprises of the relative share of machinery and equipment produced for the first time in the USSR and reduction in the total volume of products of the share of machine-building items in the age of the first three years of series production with a growing share of machines aged 10 years or more. The average yearly share of retirement (as a consequence of wear) of machinery and equipment lags significantly, comprising in 1979 (in percent of the total pool) for the industry on the average only 2.4 percent. The share of retirement of machinery and equipment is still lower in the machine-building, chemical and petrochemical

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sectors and especially in metallurgy. According to the calculations of the Institute of Economics of the USSR Academy of Sciences, a gradual increase (with consideration of an increase in the total pool of equipment through putting new machines into operation) of the percentage of retirement amounting to a factor of 2.0-2.5 (and for metallurgy, machine building and chemical industry--even higher) is needed. In plans for the development of machine building, it is important to determine, utilizing economic stimuli, the attainment of a significant turning point in the dynamics of all these indicators. The increase in the percentage of retirement of obsolete machines should be based on planning their replacement with new high-quality machines as a result of improvement of the structure of machine building with an increasingly greater reduction of the relative share of capital repairs (frequently consisting of twofold reproduction of obsolete equipment) and its use for the technical renewal and modernization of equipment.

To increase the incentive of collectives and personnel of enterprises, associations and ministries for producing and using new high-efficiency equipment, the presently planned indicator of economic effect from the realization of scientific-technical measures in production should be included among the indicators on whose basis cost-accounting incentive funds are formed. The effectiveness of planning and stimulation of scientific-technical progress largely depends on how precisely the enterprise, association and ministries know what economic effect, expressed in cost-accounting indicator, is actually produced from the creation and use of new equipment. The reflection of its effect in such indicators constitutes one of the significant conditions of an organic union of control of scientific-technical progress with general economic control. Streamlining and a significant improvement of the entire system of determination of the economic effect produced by new equipment are required at the present time (with account being taken of the social results). At the present time, the actual effect is essentially determined by computation, and it is based to the required degree on initial accounting. Inadequacy of information on the effect produced by scientific-technical progress reduces the quality of planning and selection of new equipment and the effectiveness of planning and financing of scientific-technical progress and deprives it of stimulation of a rather precise base.

Orientation of Science and Technical Developments Toward a High Level of Quality and Effectiveness

The creation of advantages for enterprises, associations and ministries, assimilating new high-quality equipment and the significant growth of their motivation in producing, learning to operate and using it make possible and necessary a considerable rise in the requirements for technical developments to the qualitative level of planned new equipment. At the same time such an orientation of technical developments can be ensured only through large changes in the direction of development of sectorial science. A significant defect of many sectorial institutes exists in the considerable predominance of subjects of little efficacy for the national economy. Work based on inventions (and the greater part small ones at that) comprises less than one-third on the average for sectorial institutes. The present order of establishing topics namely favors such work. Assessment of the activity of institutes is conducted frequently from the position of "volume of work" rather than the effect and quality of the end product and creates greater "advantageousness" for themes that are of little efficacy for the national economy. Topics, however,

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having for their aim new high-efficiency equipment for the national economy, usually requiring more extended time for research, development and assimilation, large expenditures at this time, considerable additional effort for the solution of complex tasks and the like, are frequently relatively "disadvantageous" for institutes.

It would be advisable to gradually change over--on the decision and under the control of the USSR State Committee for Science and Technology--to a system of determining the subject matter of sectorial institutes, the basis of which primarily would be inventions producing a big national-economic effect. The sources of formation and realization of subject matter here would be: first, employment of the results of basic research producing discoveries and major inventions; second, the use of other highly effective inventions; third, the selection of such subjects whose end result would be an invention yielding a significant effect. On the basis of appropriate directive decisions in methodical instruction, it would be necessary to determine for this the procedure of compiling plans of sectorial institutes with an obligatory condition: initially, there should be examined in detail the indicated sources of use and creation of inventions and only after this should the question be brought up concerning other sources of formation and realization of this or that theme. The approval of a topic not based on an effective invention should be validated by the institute with corresponding argumentation.

This will require putting the evaluation and stimulation of the operation of the institute (norms of formation and utilization of cost-accounting funds, sizes of bonuses for corresponding personnel) in direct dependence on the place of effective inventions in its work. The need has been created for ensuring unconditional priority through material incentives of highly effective works based on effective inventions, while works of little efficacy should become significantly less "advantageous" for an institute. It would be advantageous to adopt a decision on corresponding changes in material encouragement of collectives and individual personnel of scientific-research institutes. A criterion for assessment of work must be the economic effect with consideration being given to the solution of social problems and also in addition to this to the significance of the work for the national economy, the qualitative level of attained new technical parameters, comprehensiveness of research and its prospects.

On such a basis the results of work will receive high or lower marks with a point system for material encouragement. In the payment of bonuses for work producing a major effect and receiving high point ratings, it is necessary to pay advances whose size must be related to the point rating. For work of little efficacy, advances in general should not be paid at any time of its realization.

For raising effectiveness in the work of sectorial institutes, there should gradually be introduced new forms of wages aimed at the elimination of existing elements of regulations and significant strengthening of a differentiated approach to pay through the expansion of the range of positions and the establishment of significant differences ("forks") in pay for each position depending on the quality and effectiveness of work of each scientific worker. The publication by the USSR State Committee for Science and Technology of an appropriate decree on a gradual dissemination to institutes of such a procedure of remuneration with subsequent accounting of the specific character of

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each institute would be advisable.³ New forms of remuneration at scientific-technical institutes should be combined with considerable emphasis on the effectiveness of certification of scientific workers for the purpose of raising the level of research and development and advancing new, fruitfully working scientific cadres.

These changes in the system of remuneration would contribute to the solution (on the basis of an appropriate decree) of another task--the provision of greater flexibility and maneuverability for the structure of management in sectorial institutes through a significant increase of the relative weight of problem and thematic subdivisions designed for the fulfillment of a particular theme. Changes in remuneration of labor will make it possible to ensure material interest in the formation of such movable subdivisions; this will create conditions for timely shifting of research and development to a new topical theme, including one that previously had not been considered. In conformity with the position of the plan of "Basic Directions" on the development of cost-accounting relations at scientific-research institutes, it would be advisable, in our opinion, to provide sectorial scientific institutes with working capital, which should raise their effectiveness and responsibility for the results of work.

The direction taken by sectorial science to the creation of highly efficient equipment must be realized and continued by having technical development and the system of selection of new equipment assume the same direction. At present only a significantly smaller part of technical developments (planning new equipment) creates equipment on the level of the highest category of quality. It would be advisable to establish a step-by-step boosting of requirements for a qualitative level in the selection of new equipment for production in accordance with the task assigned in the plan of "Basic Directions" and to make more rigid the efficiency requirements of new equipment. In the long term, it would be advisable, in our opinion, to put into production, as a rule either basically new equipment with nothing comparable or other new equipment considerably superior in efficiency and quality to existing either domestic or world comparable equipment (any essentially new equipment exceeds the qualitative level of the best existing equipment of the given type, embodying the antecedent technological principle).

But, taking into account the actual situation in regard to the qualitative level of equipment, initially it would be advisable, as has already been mentioned, to carry out on the basis of large preparation a gradual transition to the following principle: each technical product created for the first time may, as a rule, be considered new if it meets the requirements of the highest category of quality and as a minimum corresponds in effectiveness to the best comparable examples. But in the immediate future, there should be established, in our opinion, differences in the evaluation of different types of new equipment exceeding the existing level of quality of the best domestic examples and corresponding to them. At the same time, it would be expedient in the future to differentiate models: those exceeding the world level; those corresponding to it; those lagging behind it. Between the superiority

3. In the future, there should be considered in our opinion, the question of the broader use of such differentiated pay in the spheres of academic science, technical developments and in industry.

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or correspondence of the best models there exists an essential and significant difference in a practical sense, since the main idea of selecting equipment as new consists in the fact that it possess technological and social-economic advantages compared to already existing equipment. There is a need for methodological positions in correlating the relations of these groups of high-quality equipment and establishing differences between them in incentives and size of price increases for quality.

At the same time, changes should be introduced, in our opinion, in the conditions of awarding the Seal of Quality. The main thing is that an insufficient relation exists between it and the economic effect, which must become the deciding factor in awarding the Seal of Quality. At the same time, there is a much greater need to tie in awarding of the Seal of Quality to technical progress and to innovation of equipment. At the present time, new equipment occupies an insignificant share in the mass of products (including those of production-technical use), which have been awarded the Seal of Quality; its relative share, however, in these products is being reduced. The quality and newness of equipment, as well as the social-economic results of its use by their very nature constitute a unity. Society does not just need newness of equipment but high-quality parameters for this newness, which furthermore are organically combined with high social-economic results. Equipment may be considered as new by socialist society because it possesses high quality in its technological, economic and social aspects.

Awarding of the Seal of Quality must be tied in to social indicators. It is important not to award it to products, including new equipment, if they do not meet social norms for improvement of working conditions and protection of the natural environment. An obligatory condition of awarding the Seal of Quality to a technical product would be correspondence of the parameters of the new equipment to the concrete requirements of the spheres of its use (including improvement of the conditions of operation of the equipment). It would be advisable for awarding of the Seal of Quality to be differentiated according to concrete specialized modifications (varieties) of a model of new equipment intended for certain spheres of use: it should be awarded to those of the varieties of the model which are adopted to the needs of the sphere of use and produces in it a high effect. It is important also to realistically take into account what the competitiveness of the equipment would be on the world market.

To raise the level of applied research and technical development, there should be accelerated into practice the introduction of promising, "leading" standards for products of technical production function so that these standards are closely connected to applied research and technical developments and are used as norms in the transition to new models and types of equipment.

A significant prerequisite of orientation of technical developments to the creation of high-quality equipment and the implementation of higher requirements for its selection would be the introduction in industry of nondepartmental certification (expertise) of technical developments. Its aim is maximally to contribute to raising the level of technical developments and to the gradual implementation of the principle--every development as a rule should be directed to the creation of equipment of the highest category of quality. Such promotion will serve as an effective means of control over the selection of high-efficiency equipment and verification

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of the basis of selection of an analog with which it is compared. The inclusion of planned new equipment in technical developments under the highest category of quality should be (as in certification of finished products) the function of Gosstandart and be accompanied by higher material incentives for developers.

Certification of technical developments will be found to be effective if it is accompanied early, that is, begins (as its first stage) with extradepartmental examination of technical goals for planning (it would be expedient to introduce it not only for the most important but essentially for all types of new equipment). In a technical assignment there should be included without fail a limit price for the new equipment which would be refined in the future and which serves as a barrier against the hiking of prices for new equipment and will also help lower the price per unit of useful result, eliminate and prevent instances where the price for new equipment outstrips its productivity. The second stage in the certification of technical developments is the assessment of their result at the final stage of creation of a work plan, an experimental model and their careful checking. At this stage, the obtained results will be compared with what was designated at the outset of planning, and the question will be resolved of putting the equipment into production and evaluating it according to quality categories.

It seemingly would be advisable to issue while taking into account the proposals described above: (a) a decree of the USSR State Committee for Science and Technology on improving the work of sectorial institutes and (b) a decree of Gosstandart USSR and the USSR State Committee for Science and Technology on the big linkage of quality certification of products with scientific-technical progress and its effectiveness and on conducting certification (examination) of technical developments on the basis of the highest category of quality.

The effective, highly efficient use of economic stimuli of development of two inter-related counter processes--orientation of industry toward productive realization of the latest achievements of science and technology and research and development for all-round and deep technical renewal of production--will serve in the eighties as a significant factor of increase of the tempo of the country's economic growth and completion of transition of the economy to the rails of intensive development.

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