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ECONOMIC AFFAIRS

(FOUO 18/80)

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ECONOMIC POLICY, ORGANIZATION, AND MANAGEMENT

STRENGTHENING OF LATERAL ECONOMIC TIES ADVOCATED

Moscow VOPROSY EKONOMIKI in Russian No 10, Oct 80 pp 14-25

[Article by V. Pavlyuchenko]

[Text] Improvement of lateral economic ties has great importance among the problems of improving management of the socialist economy. The system of these relations, which embraces the interaction among organizations of the same level (sector or industry with sector or industry, enterprise with enterprise, manufacturer with consumer, client with construction contractor, scientific research institute with the manufacturer of new technology, and so on), guarantees a cooperative effort and an interchange of activities and products produced. These ties take a variety of specific forms, including organization of coordinated activity of different departments and units in organizing the production of new technology and other products, fulfillment of intersector programs and creation of regional industrial complexes; contract relations among economic entities, distribution of the benefit to the national economy among manufacturers and consumers, and so on. Economic accountability of the interacting entities in social production is an indispensable element of them.

Ties "along lateral economic lines," which determine the degree of coordination of the efforts of different entities in the national economy, thereby have a substantial impact on the balance and efficiency of the economy and vigorously influence all the qualitative factors in its growth. Their further improvement is one of the principal conditions for reinforcing the orientation of socialist producers toward attainment of final results from the standpoint of the national economy, a faster rate of scientific-technical progress, shorter periods for capital construction, improved product quality, and more intensive social production as a consequence.

Intensification of the division of social labor and integrational processes in the economy of advanced socialism, brought about by the scientific-technical revolution, the rapid increase in the complexity of production and of the products produced, and the increasing diversity of social needs--all of this, along with the increase in the number of ties both in the national economy as a whole and also ties linking each production cell with its

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"economic environment" is bringing about profound qualitative changes throughout the entire system of lateral ties. There is a rapid rise in requirements with respect to stability, reliability and flexibility of these ties, and their functions are also expanding and becoming more complicated; they are called upon to promote realization of the potential for higher economic efficiency thanks to improvement of interaction among sectors and industries. Ties "along lateral economic lines" have a larger role to play in performance of such important economic functions as ensuring current balance between production and consumption in the context of ever greater diversity and changeability of needs, mutual adjustment of physical and value proportions, and attainment of smooth and coordinated operation of all parts of the national economic organism.

The problem of lateral ties is also an urgent one because shortcomings in the system they comprise have now become one of the principal obstacles to raising economic efficiency, to speeding up rates of scientific-technical progress and to improving product quality. In large part it has been the oversights in lateral ties that have given rise to "tendencies toward self-sufficiency and departmental restrictiveness," which, as stressed at the 25th party congress, must be resolutely overcome. The instability and unreliability of these ties generate the desire for economic autarky, hold back development of specialization, and motivate practitioners in the economy to build up excessive "emergency" inventories in production.

The adverse impact of departmental barriers on scientific-technical progress, on resolution of intersector problems of the national economy, on fulfillment of capital construction programs and on activation of productive potential is well known. As a matter of fact these barriers are a manifestation of nothing other than disruption of ties "along lateral economic lines." Overcoming all departmental separateness is directly related, then, to making interaction among all economic entities more effective along "lateral economic lines." A substantial improvement in the functioning of the entire system of lateral economic ties is today one of the central problems in restructuring the economic mechanism, in bringing it into conformity with the requirements of a continuously developing national economy, as called for by the decisions of the 25th CPSU Congress.

In recent years a great deal of work has been done in the national economy to improve lateral ties and to strengthen planning and contract discipline. For instance, the decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" called for major completion in 1980 of the conversion of production associations (enterprises) to direct long-term economic relations; and it defined the procedure of organizing them on the basis of contracts among production associations (enterprises) in the industrial sector and also between those associations (enterprises) and agencies of USSR Gosplan, transportation organizations and organizations of state and cooperative trade embracing the 5-year period. The decree calls for a substantial improvement

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in the orderliness of relations between clients and contractors in capital construction and between scientific-research organizations and industrial enterprises, as well as for increased accountability of manufacturers to consumers.

For all the diversity of the final results of the national economy and the variety of economic ties among organizations participating in their achievement, relations between producers and consumers comprise the fundamental link, a kind of cell of the entire system of lateral ties in the economy, a relationship that recurs a million times daily in the national economy. However many intermediate links there are on the path to attaining the final result for the national economy, each preceding link in this chain figures as a producer, and each succeeding link as a consumer, and the result of the activity of the former (intermediate with respect to the final result) is the point of departure for the latter. Attainment of any final benefit is always the result of accomplishment of a certain system of ties between producers and consumers, and each such individual tie is a step on the path to the end result.

Achievement of high final results from the standpoint of the national economy is determined not only by the performance of the producer manufacturing the final product, but also by the "closeness" and "density" of ties among those who create the intermediate results. It is therefore indispensable to guarantee that all participants along the entire chain of production are motivated to achieve the highest end results regardless of whether they are located in a distant or nearby segment, in an initial or final segment of the technological chain. Of course, an enterprise located at the beginning of the technological chain cannot directly create the end result, but it must ensure the efficient economic performance of the succeeding link, and this in turn that of the link which comes after it, and so on along the entire chain of organizations participating in creation of the final result from the standpoint of the national economy.

It is a necessity to shape an interrelated system of interests of producers and consumers, to "link up" their interests. The motivation for each enterprise to make economic ties more intensive should be made a function of how it "works" for consumers. This is a mandatory condition, as pointed out by L. I. Brezhnev at the 25th CPSU Congress, for "giving the consumer broader opportunities to influence production whether it is a case of raw materials and supplies, machines and equipment, or consumer goods."

The meeting of this requirement presupposes that enterprises figuring as consumers will have a greater role in the very stage of compiling production plans. The procedure envisaged by the decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" for shaping plans on the basis of orders and long-term contracts with producers of consumers or of trade and supply organizations representing their interests will help to improve the balance

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balance of the economy, to overcome shortages, and to bring production into fuller conformity with the diverse and highly dynamic needs of society. The machine tool building industry, for example, confronts the task of making the transition from the manufacturing of individual and separate pieces of equipment to the manufacturing of entire systems of machine tools and machines in accordance with technical assignments of consumers; these systems would be intended for the complete machining of the respective parts, including all operations from preparation to finishing. The essential thing is that the plan's impact on strengthening the orientation of economic activity of producers toward meeting the needs of consumers is reinforced by making associations and enterprises more accountable for fulfillment of obligations to deliver products in the given assortment and for improvement of product quality.

A new approach to evaluation of the performance of enterprises and associations is also needed to achieve a system of economic relations that ensure the consumers will have a greater influence on producers. This system must take into account not only the efficiency of utilization of the resources at their disposition, but also the influence they have on the efficiency of related links in social production. For instance, an enterprise that is putting into production a new and highly productive technology may at times even show a lower efficiency of utilization of its "internal" resources, but at the same time it will in future ensure a substantial rise in the efficiency of social production thanks to application of the technology that is created. Or, for example, an enterprise might increase only slightly the efficiency of utilization of resources, but at the same time, by strictly fulfilling its contract obligations and by meeting delivery dates, by maintaining the proper product quality, it may promote the smooth and efficient operation of those with whom it deals. A situation is also possible when a particular economic entity is concerned above all about its own production indicators and violates contract obligations, thereby holding back the rise of economic efficiency of related entities. Experience provides evidence that failure to deliver "kopeck" parts has disrupted the smooth operation of major enterprises and caused sizable losses. All these numerous interrelations of "local" efficiency, which is manifested at the level of enterprises, and of national economic efficiency need to be taken into account in evaluating the performance of economic entities.

Consequently, we need a broader base for assessing the operating performance of enterprises and associations. This kind of assessment must be based not only on an evaluation "from above" by superior organizations, but must also include an evaluation on the part of consumers and must take into account the impact on the efficiency and quality of operation of related economic entities. The latter should be a mandatory and thereby weighty component in the proposed comprehensive assessment of the results of economic activity. The basis of such an evaluation is the economic entity's total contribution to raising the efficiency of the economy (the growth of the benefits of the national economy) accomplished both within the entity itself and also achieved thanks to its impact in other subdivisions of the

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national economy. For any producer, then, the profit to be gained from creating an economic benefit of a certain magnitude (taking into account the time factor) on the premises of consumers must be equal to obtaining an equal benefit right "on his own premises," within the limits of the enterprise, association or ministry. In the final analysis it is a matter of indifference from the standpoint of the national economy in which unit of the economy a benefit equal in size was achieved. In the present stage, because of the objectively increasing intensity of interchange of efforts and products of labor and the resulting development of integrational relations within the national economy, in many cases the economic benefit is realized--and that means also recorded--not within that particular cell where it is created, but in other related subdivisions of social production. It is therefore indispensable to ensure equal motivation of each producer to increase the efficiency of production from the standpoint of the national economy regardless of the place where it is achieved, and not to allow the situation that has not uncommonly occurred where the benefit "of its own," obtained, for example, at an enterprise, proves to be considerably "more expensive" for it, since it is correspondingly reflected in the success indicators and incentive funds, than an equal or even greater benefit achieved on the premises of consumers in related sections of production as a result of its economic activity. For instance, at a machinebuilding enterprise, say, 100 jobs are eliminated, which means a saving on the wage fund, a rise of labor productivity and a corresponding increase in incentive funds. But if the equipment built at the enterprise makes it possible to free the same or even a far greater number of workers in other economic entities, this may not have any effect whatsoever on its economic position and on the collective's incentives.

The importance of recording the benefit to consumers and of invigorating its role in the economic mechanism results from the fact that for many industries and enterprises, especially those producing means of production, a weighty or even predominant portion of the benefit they achieve for the national economy is realized outside of their departmental and organizational boundaries. For instance, the benefit to the national economy of the operation of enterprises in machinebuilding is mainly manifested in a higher technical level, higher labor productivity, lower capital intensiveness and improvement of other economic indicators of those industries using the products of that industry. Improvement of the quality of metal and expansion of the assortment of rolled products yield a national economic benefit outside the industry, tending to increase the coefficient of effective use of metal and reducing materials intensiveness of the products of machinebuilders intending to increase the reliability and durability of machines and equipment in spheres of ultimate use. That is why a judgment should not be made of the effective performance of enterprises, associations and other organizations (from the standpoint of the national economy) on the basis of a system of indicators mainly reflecting internal results of their economic activity. Nor does strengthening the role of indicators of product quality altogether solve the problem of taking into account the contribution an economic entity has made to increasing national economic efficiency. The point is that a substantial portion of the potential benefit

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of technology of even the highest quality can be lost in the sphere of operation if ties between producers and consumers have been badly organized: insufficient assistance in applying the new technology, unsatisfactory technical servicing, unavailability of replacement parts, and so on. It is indispensable, then, that the consumers of a product make an additional evaluation of the performance of each economic entity. In our view this is the basis for strengthening the compatibility of interests and consequently the highly efficient performance of both producers and consumers.

In order to strengthen integration of economic activity, it would be advisable if in assessment of the performance of enterprises and associations a planned indicator referred to as "benefit to consumers" were introduced; it should also be made a fund-regulating indicator, provision being made for rates of transfers to incentive funds that ensure an equal size of reward for an equal benefit obtained on the premises of the given production unit and on the premises of related organizations. The additional economic benefit occurring thanks to improved cooperation and interaction of the different economic entities would be the source of funds for incentives. In our opinion provision should also be made for the possibility of redistribution of profit among economic organizations to create economic incentive funds in cases when the additional economic benefit realized by one of the participants, say, a consumer, is achieved as a result of their joint activity.* The procedure for redistribution of profit could be defined in the contractual obligations. Moreover, there is a need to work out the rules for adjustment of the profit plan and relations with the state budget relative to such cases.

This will make it possible to strengthen the financial motivation of collectives to increase efficiency at related sections of production and on the premises of final consumers of their products and to create economic conditions which would encourage use of every opportunity to increase the return on resources not only "on one's own premises," but also in other units of the national economy.**

* We should note that such a possibility for redistribution of profit among economic organizations has been provided for in the sphere of capital construction by the decree of the CPSU Central Committee and USSR Council of Ministers dated 12 July 1979. It thus points out: "If construction contractors reduce periods for activation of production capacities relative to the established allowances, the general contractor shall receive from the client funds amounting to 50 percent of the profit envisaged by the design for the period by which construction time was reduced, but not to exceed 0.5 percent of the estimated cost of construction and installation work for each month for which construction time was reduced. These funds are to be credited to the economic incentive funds of the organizations participating in construction."

** A thorough check and final adjustment of the proposed indicator would, of course, be required in advance.

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In many cases this could eliminate the problem of producing a product referred to as "unprofitable" for the producer, but needed by consumers and consequently by society. If an enterprise is manufacturing a product that requires higher production cost and reduces the manufacturer's profit, yet yields a sizable benefit in the sphere of consumption, this must have a favorable effect on assessment of its economic performance and on the collective's incentives.

The very concept of an "unprofitable" product arises when the interests of individual producers (enterprises, associations and enterprises) are not sufficiently aligned with the interests of the national economy. The only unprofitable product from the standpoint of the national economy would be that product which either does not meet the needs of society because of its low quality, failure to meet demand or other causes, or it is able to satisfy them only at an expensive price, that is, it is inefficient. In other words, there can be unprofitability of a product only for consumers, but not for manufacturers. A product that is "unprofitable" for the producer is a kind of economic absurdity, one that reflects the shortcomings of the economic mechanism. Production of any product that is necessary to the national economy and that efficiently meets needs must fully correspond to the interests of both those enterprises manufacturing it and also its consumers.

Which leads to the need to make incentives of manufacturers dependent on the full (total) benefit to the national economy of a manufactured product, in which the benefit realized in consumption constitutes a sizable portion (if it is actually beneficial to society).

Adoption of the "benefit to consumers" as an indicator would, in our opinion, have a strong stimulative effect toward strengthening relations between science and production and toward creating improved and fundamentally new technology, technology that substantially surpasses in its economic parameters the technology it is replacing. This will provide a strong economic lever for solving the problems stated in the decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Further Development of Machinebuilding in the Period 1978-1980." It calls for the productivity of machines and equipment and also their length of service before major overhaul to be increased 1.5-2-fold by 1985 as compared to 1975.

Practical implementation of the principle "work for the consumer" also presupposes further improvement of cost accounting (khozraschet). Objectively conditioned by the development of the productive forces of society, intensification of economic ties and the process of integration of economic activity necessitate a transition to comprehensive forms of cost accounting. At present the principal shortcoming in cost accounting is that its operation is confined to a considerable degree to definite limits (enterprises, associations, and so on) and is only weakly linked to other organizational units of the economy. For that reason the cost-accounting performance of enterprises mainly reflects the rise in efficiency of utilization of internal potential, while the impact of its effort on the production efficiency

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of consumers is not adequately assessed. The rise in production efficiency owing to the performance of an enterprise's collective, but occurring outside it, in related areas of the economy, at enterprises of other industries and sectors, is manifested in improvement of cost-accounting assessments of the performance of that unit largely through the price-setting mechanism, that is, when higher prices correspond to the manufacture of a more efficient product, and on that basis there is a redistribution of benefit between the producer and the consumers.

But redistribution of the benefit exclusively or predominantly through the price is not always advisable or practicable. It "hypertrophies" the distributive function of the price at the expense of its other functions, above all its accounting function. When price setting is divorced from the socially necessary expenditures, the price in time becomes less and less an expression of value, since under the conditions of intensification of production an ever larger share is assumed by that part of the price which is called upon to reflect the economic benefit. And divorcing the price from value means that sooner or later its functions as an incentive will necessarily break down. It is also very important that in the context of wholesale prices which remain stable for the 5-year period, as envisaged by the July (1979) decree of the CPSU Central Committee and USSR Council of Ministers, such a redistribution of the benefit becomes in many cases impossible or very difficult for purely technical reasons.

In actual economic practice cases are frequent in which a benefit could accrue to consumers though the price level remained unchanged, and consequently they could not be distributed in the manner indicated above (through the price).^{*} But even here there should also be an incentive mechanism in operation that would guarantee alignment of interests. Moreover, the cost-accounting assessment of the performance of the enterprise which is the manufacturer must not suffer even when the prices of its products are reduced in order to attain better end results on the basis of the interests of the state and consumers. The profit which as a consequence does not accrue to one unit of the national economy may bring a sizable benefit in other units, and a corresponding amount of compensation should be made to the producer, and his incentive funds should rise. This would make it possible to avoid the situation in which a reduction of wholesale prices on a product already produced has an adverse effect on the cost-accounting results of enterprises, and it would give them stronger motivation to engage in planned price reduction.

^{*} Such situations occur, for example; when there is a rise in the quality of the product produced, when this increase does not result in its moving into the superior-quality category, when aggregate deliveries of machines and processing equipment are made on schedule to construction sites, when the specific requirements of consumers are taken into account, when the manufacturer improves the services he provides for equipment that is in operation, and so on.

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Insufficient reflection of the impact which enterprises have on those with whom they deal in the cost-accounting results of their performance is one of the reasons for organizational and departmental divergence. At a time when increased integration of the activity of socialist producers is one of the principal prerequisites for increasing economic efficiency, in our view it is becoming ever more urgent to make the transition from cost accounting in the narrow sense, reflecting mainly relations between society and socialist enterprises and oriented primarily toward evaluation of the internal performance of the producer, to comprehensive cost accounting conceived in the broad sense, which should be directly related to the economic unit's contribution to the rise of production efficiency of consumers and to the fullest satisfaction of their requirements. Assessment of fulfillment of the plan, cost-accounting performance, and the formation of incentive funds of producers should be set up so as to depend rather strongly on the kind of impact their activity has on the performance and economic condition of consumers. What we are saying is that the consumer should play an active part in evaluating the economic performance of the producer, should have the "deciding vote" in determining his contribution to attainment of the end results from the standpoint of the national economy. The basis for this could be recording the benefit accruing to consumers in evaluating the performance of each economic entity, which will make it possible to organically combine the interests of producers and consumers, to make them inter-related when realization of producers' interests is directly dependent upon serving the interests of consumers.

When this approach is taken, an effective instrument becomes available for improving relations among sectors and industries. As we know, it is precisely at the junctions between sectors and industries that the largest potential exists for increasing the efficiency of social production. For example, there is the problem of the interaction of the complex consisting of "the coal industry--transportation--the electric power industry." At present suppliers ship coal without prior beneficiation, and sometimes the content of gangue and water goes as high as 40-45 percent. Beneficiation of the coal at the mine to free it of gangue would make it possible to make thousands of railroad cars available, to reduce the specific consumption of fuel at power plants and reduce the cost of generating electric power, and to guarantee a sizable benefit to the national economy. Solving this problem will be far easier and will move far faster if the benefit accruing to consumers begins to occupy a significant position among the criteria for evaluating the performance of economic entities (and correspondingly in the system of incentives) and if the interests of the sector or industry are directed toward attainment of the best results in the transportation sector and electric power industry. The same thing applies to organizing the interaction of other extractive industries with transportation and manufacturing industries. In our view this is one of the important ways of optimizing freight traffic and reducing the load on the transportation system, of increasing the content of useful components in the raw material and of boosting the growth rates of efficiency from the standpoint of the national economy.

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It is not possible in the space of one article to outline in all detail the ways in which the proposed comprehensive system of cost accounting would be put in practice, the solution of such a problem requires joint efforts of many economic experts, both scientific and practical. The most important things are the very posing of the problem and definition of the main outlines and general direction of further improvement of cost accounting, so that it contributes in every way to overcoming the organizational divergence and thereby to intensification of social production. This is the approach (from solving general problems to particular problems) that should be taken in solving the complex problems of theory and practice, since "whoever takes up particular problems without first solving the general ones will inevitably be 'bumping up against' those general problems at every step without even knowing it."*

There are various ways open to solving the problem of setting up the proposed system of cost accounting; they require further theoretical research and performance of economic experiments. But it is possible even now to formulate certain general principles governing the approach to setting it up.

The indicator referred to as "benefit to the consumer" should be made the basis of the system of cost accounting that links the interests of producers and consumers, equal incentives should be provided for equal benefit "on one's own premises" and for benefit accruing to related production entities, provision should be made for the possibility of redistribution of profit among economic organizations to form incentive funds at enterprises guaranteeing a growth of the benefit accruing to related entities. The first need here is for organization of reliable statistical recordkeeping on the actual economic benefit accruing to consumers of a product and realized thanks to the performance of the producers. It would be best for the size of the anticipated benefit accruing to consumers to be reflected in business contracts at the time of their conclusion, but the benefit actually attained must be confirmed when fulfillment of contractual obligations is evaluated.

Stimulation of collectives as a function of fulfillment of contractual obligations to consumers, as envisaged by the decree of the CPSU Central Committee and USSR Council of Ministers on improvement of the economic mechanism (1979), is important to development of cost accounting along these lines.

Improved alignment of the interests of collaborating economic entities also necessitates solution of certain other problems which have been little studied. One of the most urgent of them is to ensure that evaluations of the performance of interacting organizations and of superior and lower-level economic entities do not contradict one another and are in alignment.

* V. I. Lenin, "Polnoye sobraniye sochineniy" [Complete Works], Vol 15, p 368.

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At the present time evaluation of the performance of related entities performing a particular economic task is often based on differing criteria. For instance, the system of economic indicators and incentives orients construction crews operating on a contract basis to reduce construction time, to improve the quality of construction, and to make efficient use of manpower and physical resources; enterprises in the building materials and fabrication industry supporting their work are evaluated according to the output of structural fabrications and materials in cubic meters and in value terms, and the transportation sector is in turn stimulated to fulfill the plan in ton-kilometers. This discrepancy in criteria used to evaluate performance and accordingly in determination of incentives makes it more difficult to coordinate the interests of scientific and production organizations, material and technical supply agencies and industrial enterprises, raw materials industries and manufacturing industries, transportation and trade. Improvement of lateral economic ties, then, is making it necessary to conduct theoretical research into the problem of aligning the criteria used in evaluating the economic performance of related organizations (cooperating with one another). The result of that research should be development of a system of interrelated and compatible "start-to-finish" indicators of interacting economic units and entities that ensure alignment of their interests in attainment of high final results from the standpoint of the national economy.

Ties among sectors and industries and among organizations are in need of substantial improvement. It is high time to improve procedures for aligning planning decisions and other economic decisions, for establishing interaction with related sectors and industries or enterprises, and the procedure for settlement of business disputes and mutual claims. The administrative procedures in effect at present as a rule are extremely complicated, they involve the participation of a large number of supervisory personnel and go through many different levels (which still does not always guarantee high quality of the decisions taken), and they take a long time. This is one of the principal reasons for the overload on management agencies, including the upper levels, and it considerably reduces responsiveness and flexibility of management and complicates the establishment and functioning of ties along lateral economic lines. It is therefore becoming very urgent to develop more orderly procedures for taking decisions by agreement among different organizations and departments that will eliminate excessive restraints and clearances and will reduce the number of levels involved, while unfailingly enhancing the responsibility of those who make those decisions.

One of the most important conditions for improving lateral economic ties is to strengthen further the economic responsibility of enterprises and associations for the fullest and most efficient satisfaction of the requirements of consumers. Under the decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" the responsibility of producers to consumers is being

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reinforced--the formation of their material incentive funds is made dependent on fulfillment of the plan for deliveries in accordance with the list specified in business contracts (orders), and if these deliveries are not made, transfers to incentive funds are reduced. The changes the decree envisages in the system of economic accountability, which are aimed at strengthening the synchronization (proportionality in time) of the activity of all entities of the national economy, and adoption of strict penalties for wasting time have great importance to increasing production efficiency and to improving satisfaction of the needs of production and personal needs.

But the very system of assignment of orders for the production of new products, equipment in particular, is in need of improvement. The sizable and moreover increasing volume of orders which are not accepted, which means that they are not filled, indicates undersatisfaction of the needs of society and should have an effect on the overall assessment of performance of the respective economic entities. Evaluation of the quality of performance of associations and sectors or industries with respect to the degree of satisfaction of the needs of the national economy should take into account not only fulfillment of contractual obligations, but also refusal of customers' requests for production of a product they need. In our view it would be wise for USSR Gosplan, USSR Gosstab and ministries to keep regular records and to analyze orders which are not accepted in order to work out planning decisions aimed at eliminating shortages and disproportions.

There is good reason to enhance the economic accountability of producers for the products they manufacture. At the present time industrial enterprises and associations bear limited responsibility for the products they produce, an accountability that is operative only during the warranty period of the product's use. The accountability of institutes, design and process engineering organizations for new technology and processes they develop and of construction organizations for the quality of construction actually ceases at the moment when their products are accepted by consumers. As a result consumers have difficulties when they are introducing new technology, the efficiency of its use in the national economy is reduced (because of idle time of a portion of the machine pool because of below-standard technical servicing, because of a shortage of replacement parts, and so on). In the sphere of consumption sizable losses not uncommonly occur through the fault of manufacturers, yet often they are hardly taken into account at all and have no appreciable impact whatsoever on the economic condition and incentives of those producers. In actuality it is the consumer who pays for designs which have not been perfected and for equipment and other products whose quality is inadequate; it is he who incurs the additional expenses and losses that are involved. In the final analysis a portion of the benefit to the national economy is lost.

In our opinion the responsibility of scientific research institutes, project planning and construction organizations, design offices, and so on, for the quality of work they do up to the stage of attainment of design capacity and the assigned technical-and-economic indicators of projects built

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according to their designs should be extended, and economic accountability for the quality of the product produced should be substantially extended in time. In the future this kind of accountability should encompass the entire period of operation of equipment in the national economy. It should become obligatory for manufacturers to service the equipment they produce on the premises of the consumer over its entire service life, including furnishing replacement parts for it. In this case when the quality of the product manufactured is not sufficiently high, this will sooner or later have an effect on the economic condition of the producer, since the lower that quality, the more it will cost him later to service the equipment on the premises of the consumer. This would substantially enhance the motivation of enterprises to improve product quality.

Improvement of the system of lateral economic ties is one of the main conditions for speeding up scientific-technical progress, which is expected to make a decisive contribution to the rise of the efficiency of social production. Solution of a considerable portion of the problems related to creating new technology, to capital construction and to raising the technical level of operating enterprises is an intersector matter and consequently depends on the orderliness of ties "along lateral economic lines." As experience indicates, at present many innovations "get hung up" precisely at interdepartmental junctions, when they are making their passage from science to production; these are the tasks of scientific-technical progress, which should ensure effective interaction of a number of organizations of different ministries, which are being solved most slowly.

Using the benefit accruing to the consumer in order to improve lateral economic ties in the sphere of scientific-technical progress has certain specific features. Not uncommonly in the initial period of application of new technology the enterprises introducing it incur additional costs and sometimes even losses, and that slows down its application. But the size of those costs and losses, as well as the time required for economic application of new technology depend largely on interaction between its manufacturers and consumers; they can be substantially reduced if the producers extend energetic scientific, technical and other aid to organizations applying the technology. It is a different matter when the consumer is left to his own devices and applies technology without the help of the manufacturer, on his own responsibility and risk. At the same time new technology should ensure that a certain benefit to the national economy is obtained over its entire service life, and the size of that benefit reflects the quality of performance of the enterprise that produces it. All of this gives rise to the following peculiarities in stimulating manufacturers of new technology on the basis of the benefit accruing to consumers. First, the total size of the benefit accruing to the consumer should be defined as the difference between the benefit to the national economy of applying the new technology over the entire planned service life and the costs and losses during the period of introducing it. Second, the payment of incentives to the producer should begin only after the initial period of attaining rated capacity has been completed, when the actual realization of the

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benefit to the national economy begins. This approach will motivate manufacturers of new technology to extend effective aid to consumers, thereby reducing both the time and cost of bringing new technology up to rated capacity.

In certain cases when new machines and equipment, progressive materials and high-quality products are being applied, there may be several economic links between the producer and realization of the economic benefit to the national economy--it may occur not on the premises of the direct consumers of its product, but in other more remote units of the economy. For instance, improvement of the quality of materials used in designs provides most of its benefit to the national economy not in the production of machines and equipment, but in the spheres where they are used because of improvement of their technical-and-economic parameters. Here the consumer "closest" to the producer will figure as a kind of intermediate link to the unit in which the high benefit to the national economy is actually achieved. In such cases the benefit at the place where it is realized needs to be recorded not only on the premises of direct consumers, but also on the premises of consumers at one or two removes, that is, in subsequent links of the technological chain.

The author does not claim to have exhaustively covered all aspects and facets of the problem taken up in this article. Strengthening plan discipline and introduction of target-program methods of management, improved balance in production and creation of reserves so that the necessary economic maneuvers can be accomplished, the shaping of progressive organizational structures of management, etc., have no small role to play in solving it. The importance of socialist competition is also great--thanks to its broad scale and further development closer ties are created among competing collectives, and the unity and integrity of the national economic organism is reinforced. Consequently, we need to take into account the sum total of factors involved in improving lateral economic ties in our further work on the theory of the problem and in conducting practical measures in this area. Only if a comprehensive approach is taken to solving this problem is it possible to substantially reduce and eventually eliminate departmental and all other organizational separateness by strengthening the unity of interests of socialist producers in increasing the efficiency of economic activity.

Improvement of lateral ties is now one of the key problems in perfecting the economic mechanism. Greater conformity to plan of the effort to organize them and to improve their reliability and flexibility is an indispensable condition for taking into account those new requirements which, as L. I. Brezhnev points out, "are being imposed by new technology and processes, by the growing interdependence of sectors and industries and production entities, and by the entire present-day makeup of our economy."*

* L. I. Brezhnev, "Leninskim kursom" [On Lenin's Course], Politizdat, Vol 6, p 326.

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ECONOMIC POLICY, ORGANIZATION, AND MANAGEMENT

KVASHA'S BOOK ON PRODUCTION TIME FACTOR REVIEWED

Moscow VOPROSY EKONOMIKI in Russian No 10, Oct 80 pp 139-141

[Review by V. Krasovskiy of the book "Faktor vremeni v obshchestvennom proizvodstve. Ekonomiko-statisticheskiye ocherki" by Ya. B. Kvasha, Izdatel'stvo Statistika, 1979, 152 pp]

[Text] The monograph we are reviewing [The Time Factor in Social Production. Essays in Economic Statistics] is Ya. Kvasha's last scholarly work, completed not long before his death. This book is devoted to an analysis of the time factor--an exceedingly important characteristic of intensification of social production in the period of advanced socialism. It thoroughly examines the multifarious phenomena of economic life related to the time factor.

As it is rightly remarked in the foreword, all of Ya. Kvasha's attributes as a scholar are vividly manifested in the book. The author goes further than to systematize an enormous amount of statistical and factual material, masterfully processing the data and scrupulously analyzing it. The monograph is typified by a broad national economic approach to the problem of production time. It discusses both microeconomic (vnutriproizvodstvennyy) and also macroeconomic (obshcheekonomicheskiy) factors; the rates at which new technology is being disseminated and the instruments of labor and all manufactured products renewed. Consequently, the author sketches a broad picture of the actual and possible movement of the overall process of social production, beginning with the conception of new technology and extending to its widespread use. The analysis of production time in different sectors and industries ends with theoretical conclusions on the impact it has on the value and technical configuration of production, which has great importance both to sectors and industries as economic entities and also to the political economy of socialism.

In the present context of the intensification of production there is a particular urgency in the problems of improving methods of recording the time factor in planning and stimulating production and in computations of the efficiency of capital investments. In the report address of the CPSU Central Committee to the 25th congress L. I. Brezhnev pointed out: "In the

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entire effort to improve management the time factor must be fully taken into account. In the field of planning this means: precise recordkeeping not only of money and resources, but also of the times necessary to carry out various projects, and to select the variants which will yield the fastest return. In the area of incentives this means tightening up time-saving and strict penalties for wasting time."

So, the saving of time in all its forms is now the key problem in performing the tasks of improving the planning and management of the national economy. An especially large role is played here by development projects related to speeding up the production process, to shortening the turnover time of physical resources and working capital, to study the obsolescence of means of labor, to reduce the period required to design and build new projects and to reach rated capacity at them, reduction of the time for filling orders and making deliveries of products to consumers, etc. Increasing the effectiveness of the economic mechanism necessitates adoption of the methods of economic evaluation of the time factor and a drastic shortening of production and investment cycles.

Ya. Kvasha's book consists of a foreword and five chapters. The book's logic is as follows. First the author analyzes the problem of rates of dissemination of new technology throughout physical production as a whole and in its principal sectors--agriculture, industry, construction and transportation. He goes on to discuss ways in which the operating life of equipment is shortened and the impact this has on intersector proportions. Retirement coefficients are given both for fixed capital as a whole and also for buildings, structures and equipment. A study is then made of the rate of renewal of products and manufacturing processes in physical production. By contrast with the first two groups of problems, this is mostly theoretical subject matter, and the author's attention is turned not so much to studying statistical data as structural shifts in production, the dynamic pattern of capital intensiveness and changes in development of capital goods industries.

A great deal of space in the book is devoted to a description of production time in the construction industry and of work times in the industries making up the industrial sector. Whereas in capital construction the time required to build projects and to activate production capacities is regularly monitored, in the industries making up the industrial sector such an important and comprehensive indicator as production time is not always recorded and planned by any means. Often it is thus very difficult to analyze the summary indicators for the industrial sector as a whole and for the industries making it up.

The book concludes with a presentation of the methods of computing the value structure of production. At first this subject appears somewhat divorced from the book's principal contents and would seem not to be related to the problem of assessing the time factor. But that is not the case. In this section the book demonstrates how important it is to correctly record

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the role of the time factor in summary national economic indicators. To be specific, this requirement should be met by the capital-worker ratio, which as a rule is calculated for the annual period, whereas it should be determined for the length of the production cycle. Likewise in analysis of the value structure of production a comparison should be made of fixed capital at residual value plus average annual working capital and work in process with the wage fund over the period of the production cycle, rather than for the year, as is often done. Thus Ya. Kvasha makes a case for revising the method of computing a number of important overall economic indicators so as to take into account the time factor.

The author completed his study, as A. Notkin, corresponding member of the USSR Academy of Sciences, remarked in his foreword, at a time when information on fulfillment of the Ninth Five-Year Plan (in its last years) was still lacking, and the 10th Five-Year Plan was only in the drafting stage. Though definite changes have taken place in the USSR national economy since that time, the methods of analysis and quantitative study of the time factor proposed in the book have retained all their importance. Ya. Kvasha succeeded in formulating a number of very bold and original proposals for solving this problem.

Among them an important place is taken by the monograph's study of the set of problems related to renewal of fixed productive capital and above all its active portion and the allowable length of service. Timely and systematic renewal of productive plant represents an important potential for raising the output-capital ratio. The use of outdated and worn-out means of labor at enterprises is standing in the way of improvement of economic indicators, is tying up sizable labor resources, and requires disproportionately large outlays for repairs, which often are made at a low technical level. Calculations which Ya. Kvasha once made demonstrated that in physical production the average piece of equipment was repaired four times during its length of service, and in the industrial sector the average was three times, and the costs of major repairs after the first time were 460 and 400 rubles per 1,000 rubles of value of the equipment repaired, respectively. It would take into account that the average age of machines in our industrial sector is 21.5 years, and the operating period up to the first major overhaul is 6 years, according to the figures of Ya. Kvasha, then over the remaining 15-16 years the equipment is kept in working condition only thanks to major repairs which are able to maintain its capacity, but on the old technical basis. A pattern like this was not of course conducive to technical progress, but held it back.

Under present-day conditions, meanwhile, the task consists of making a gradual transition from reproduction of assets on the old technical base to modernization of existing capacities so as to take technical innovations into account. This should be furthered, for example, by stepping up plant manufacture of replacement parts and by reducing their primitive production in small repair shops. These problems are discussed in the second half of the book, where a scientific set of methodological procedures are proposed

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for analyzing the length of service of means of labor and the rate of their renewal. The author takes pains to avoid using unreliable indicators in determining length of service and rates of renewal of plant and equipment, calling attention to the uncomparability of valuations of old and new assets, particularly in connection with the recommendation of the instructions in effect that obsolescence be taken into account in such computations. Ya. Kvasha also emphasizes the importance of recording the rate at which new capital is activated.

Voluminous factual material is called upon in the work concerning the problems of renewing the country's plant and equipment, long-term statistical series are developed, and shortcomings in the present system of recording fixed capital are noted, which provide very valuable and new information on aspects of the process of reinvestment in the Soviet economy. According to the data of Ya. Kvasha, the singularity of this process lies in the fact that over a long period it took place to a considerable extent by virtue of repeated major repairs and to a lesser extent by means of replacement of worn-out equipment (page 91). Moreover, in a number of cases this new equipment did not have advantages over the equipment replaced with respect to its level of productivity and the number of workers required to run it. More productive equipment went mainly to new enterprises. The author emphasizes that this pattern of the process of reinvestment is revealing its adverse aspects more and more: weighing down the stock of machines with outdated models and adding to the strain on the balance of labor resources, which in turn tends to reduce the number of shifts of operation of machines, not only old ones, but new ones as well.

Ya. Kvasha accordingly recommends that obsolete machines be gradually withdrawn and the transition be made to a two-shift and, where possible, three-shift operating schedule, using more productive machines and without hiring additional workers. At the same time there should be changes not only in the operating schedule of enterprises, but their output of the more productive equipment, especially automatic equipment, should also be increased.

The author calls attention to that paragraph of the new instruction on depreciation deductions which points to the advisability of charging "expenditures to acquire new equipment to replace outdated equipment whose major repair is economically inadvisable" to that portion of depreciation deductions which is earmarked for major repairs (page 93). But he refrains from the attempt to solve this problem without proper restructuring of machine-building, machine tool building in particular, which must reorient itself toward the needs of reequipping existing enterprises.

There are many important and interesting things in the section of the book entitled "Production Time in the Construction Industry." Ya. Kvasha rightly observes that by definition construction is the only sector of the national economy where production time is statistically observed on a regular basis. This is no accident, since the construction cycle is usually measured not in days and weeks, but in years. Moreover, the benefit from

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reducing this cycle is also particularly large: for most construction projects it runs into millions of rubles.

To suit the context of the construction industry Ya. Kvasha tries to calculate sufficiently aggregated and representative indicators reflecting production time not confined to individual projects or subsectors. For instance, he gives average construction times for the entire national economy, including separate construction times for the production and nonproduction spheres. In this chapter he studies differentiation of construction times with respect to a variety of factors, for example, for new construction projects and reconstruction and expansion projects, for groups of construction projects as a function of the level of the estimated cost, with respect to the relationship between rated and actual values, etc.

The book calls attention to the discrepancy between the estimated cost originally approved and the actual cost, emphasizing that setting the construction cost too low has an adverse effect on construction time, since there is then difficulties in financing construction projects, in their material and technical supply, etc.

All of these issues, along with the problems of renewing capital, the rate of technical progress, etc., which are taken up in the book, have retained their urgency and topicality up to the present. At the same time, very precise and original methodological approaches were taken to studying each of them, extensive factual material was used for verification, and important practical recommendations were drawn from the work. In a sense this monograph can serve young scholars as a model of a meaningful, creative and original work devoted to the most crucial problems of capital investment policy. It is recommended for a broad range of specialists--economists, statisticians, and also teachers.

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PLANNING AND PLAN IMPLEMENTATION

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BUNICH DISCUSSES STEPPED-UP PLANS, INCENTIVES

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 10, Oct 80 pp 65-77

Article by Corresponding Member of the USSR Academy of Sciences P. G. Bunich:
"Stepped-Up Plans and Stimuli of the Optimum Development"

Text The main tasks facing Soviet economic science are specified by the decisions of the 25th CPSU Congress and the decrees of the party and the government on the improvement of the economic mechanism. Their concrete expression as applied to the USSR Academy of Sciences is contained in the decree of the session of the General Meeting of the USSR Academy of Sciences (December 1979). The academic institutes are oriented by this decree, in particular, toward the elaboration of the problems of planning and cost accounting. Within the framework of these problems the adoption of those systems of economic management, which, as was stated at the 25th CPSU Congress, would stimulate enterprises to adopt (and, of course, fulfill) stepped-up plans, to save resources, to reduce the production cost and at the same time to assimilate more rapidly new types of items and to produce products of high quality and in the necessary assortment, is of great importance.

One of the important conditions of the achievement of high end results in the socialist economy is the adoption of stepped-up plans, which predetermine the development of the country. The economic mechanism, which is being created at enterprises, associations and in ministries in conformity with the decrees of the CPSU Central Committee and the USSR Council of Ministers on the improvement of planning and the perfection of the economic mechanism, is called upon to further this.

These documents mark a historical stage on the path of the formation of an economic mechanism, which is equal to the economy of mature socialism. The enforceable enactments, which were passed in their execution, stipulate a set of measures on the interconnected development of planning and economic stimulation, which along with other components includes the elaboration, as a rule, of uniform standards of wages and the incentive funds, as well as other elements, which stimulate the interest of collectives in the optimization of plan assignments.

To set off better the importance of the indicated innovations, let us analyze first of all the prevailing practice of stimulating collectives from the standpoint of its influence on the intensity of the preplanning demands from below.

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At present the principle of the fulfillment of the plan is the basis for the evaluation of the activity of labor collectives. This principle is used both at operating enterprises, with respect to which the planning assignments became obsolete a long time ago, and at the majority of new construction projects, at which the general principles of operational activity are applied to the rules of planning and stimulation. Only in isolated instances are the plan and evaluation indicators of new construction projects removed from the approved plans (the Volga Motor Vehicle Plant and others). After the achievement of these indicators the principle of stimulation for the fulfillment of the plan regardless of its level also comes into force here.

Serious contradictions are inevitable with such an approach.

According to the results of the fulfillment of the plan during 1978 the Ministry of Construction, Road and Municipal Machine Building looks better than the Ministry of Instrument Making, Automation Equipment and Control Systems, for the former ministry fulfilled the plan on the sale of products by 102 percent, while the latter fulfilled it by 101 percent. But if we compare these ministries according to the increase of production, the picture is completely different--the instrument makers provided an increase of 10 percent, while the Ministry of Construction, Road and Municipal Machine Building provided an increase of 3 percent. From the point of view of the fulfillment of the plan on sales the Minister of the Construction Materials Industry surpassed the Ministry of Machine Building for Animal Husbandry and Fodder Production (100.6 percent as against 100.5 percent), in the growth of production the indicators are in favor of the machine builders (3 percent and 9 percent). The Ministry of the Petroleum Industry and the Ministry of the Pulp and Paper Industry fulfilled the plan on sales by 100.7 percent, but the former ministry provided a 5-percent increase of production, while the latter provided a 3-percent increase. In 1979 the Ministry of the Chemical Industry exceeded the plan, but the increase of sold products as compared with 1978 was only 1 percent. The Ministry of the Pulp and Paper Industry in 1979 also exceeded the plan, but allowed even a decrease of the production volume as compared with the preceding year by 5 percent. In the past three years the increase of labor productivity at the plants of the Ministry of Construction, Road and Municipal Machine Building was about half as great as at the enterprises of the Ministry of Instrument Making, Automation Equipment and Control Systems, while the increases of wages in both sectors were approximately the same.

The gap between the incentive "for the plan" and for the achieved level of efficiency is revealed most distinctly in the case of the payment of bonuses for plan assignments, which have been adjusted downward and therefore fulfilled. As a check in the summer of 1979 showed, the associations of the Ministry of the Machine Tool and Tool Building Industry tens of times reduced the plans, which enabled them to receive 4.5 million rubles in bonuses.

The discrepancy between the indicators of the increase of production, the increase of labor productivity, the sum total of which characterizes the */economic efficiency/* */in italics/* of production (which is understood in the broad sense as the difference between the results and the paid expenses), and the degree of fulfillment of the plan assignments is explained by a number of factors. Among them are such factors as shortcomings in planning locally and at the center, the weak standard base of the plan, the needlessness of the boosting of the production of individual types of products, the occasionally inevitable decrease of economic efficiency under the influence of expenditures on conservation, on the introduction of equipment, which

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increases the creative content of labor, and so on. But it is impossible not to see as one of the main causes of the understatement of the plans on production, the profit and productivity the adopted mechanism of stimulating collectives, which evaluates them for the fulfillment of the plan regardless of the level of its intensity.

In accordance with this mechanism, the higher the level of the plan evaluation indicators (the increase of labor productivity, the increase of the proportion of products of the highest quality category and others), the greater--given the same estimated absolute amounts of the economic stimulation funds, which are released from above on the basis of the number of workers and the needs for production development funds--the incentive is per unit of real labor inputs. Moreover, the lower the plan is, the more realistic is its overfulfillment which leads to additional stimulation. The collectives, whose plans are more difficult, fulfill them with difficulty, while they do not even think about exceeding them. All this at times gives rise to the aspiration to drop to worse plan indicators, and not to rise to better ones.

Apart from this, the inadequate intensity of the plan assignments is also governed by other factors, including the complete deprivation of the management and engineering and technical personal of enterprises of bonuses in case of the slightest non-fulfillment of the most important plan directives.

The fulfillment of the plans is a question of state discipline. Their facilitation acts as unique insurance against failure. The hidden reserves of working time in the plan make it possible to have quite unnoticeably a reserve of manpower resources for overtime. The excesses of manpower resources, which are caused by low planned output norms, reduce the turnover of personnel. The amounts of above-plan products, which at times are distributed by the producers more freely than the products produced according to the main plan, increase owing to the reduction of the production plans. But the above-plan profit is necessary for converting the saving of the wage fund into the material incentive fund, for increasing the material incentive fund in connection with the fulfillment by production associations (enterprises) for each quarter and the cumulative total since the beginning of the year of the assignments on deliveries of products in the mix (assortment) and on time in conformity with concluded contracts (orders).

The collective, which has received a loan to compensate for the shortage of working capital, should repay it from the production development funds, and in case of their insufficiency should use the above-plan profit. Thereby the aspiration to obtain an above-plan profit and, consequently, the inadequate intensity of the plan assignments are stimulated anew.

The adoption of additional assignments as compared with the control figures of the five-year plan and of annual counterplans serves as an expression of the creative initiative of the workers. This advanced form of competition merits economic stimulation. But, while interesting collectives in additional assignments, it is undesirable to decrease the stimuli to draft stepped-up main plans. Meanwhile, if the main plan is not fulfilled, incentive funds are formed at the enterprises according to reduced standards; if the additional plan, which, like the main plan, is a state assignment mandatory for fulfillment, is not fulfilled, the standards are not reduced. Moreover, the bonuses of managerial personnel, engineering and technical personnel and employees for each percentage of fulfillment of the additional

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plan are higher than for the fulfillment of the basic assignments. Therefore it is economically more advantageous to the collectives of enterprises to include the maximum production in the additional plan, and not in the main plan.

The equalizing, mechanical distribution from above of additional assignments, which have to be fulfilled both by those collectives, in which reserves are envisaged, and by those, which were "imprudent," has a substantial influence on the understatement of plans.

The stimulation of collectives for the fulfillment of the plan, regardless of its intensity, not only gives rise to the aspiration of individual associations (enterprises) to reduce the assignments on production, the profit and so on, but also enables them to overstate in the plan the consumption of resources. For here it is not the level of expenditures, but only their correlation with the plan that is taken into account. If excessive resources are incorporated in the plan, the collective does not bear responsibility for this. On the contrary, the collective, which overstated the consumption of resources, gains, for excessive funds appear for it, while society loses.

It would seem that the cultivation of respect for the plan might be better for the planned economy than the stimulation of strict planning discipline. But here is the paradox: the evaluation of the activity of collectives according to the formal observation by them of planning directives, while increasing the responsibility for the fulfillment of the plans, at the same time decreases the interest in stepped-up plans. Such evaluation, consequently, does not fully conform to the tasks of the plan itself, if they are regarded from a broad standpoint--as the most important tool of the observation of the optimal, most effective proportionality, and not the balancing of production in case of its insufficiently rational level.

The stimulation of collectives for the achieved level of efficiency, the actual contribution to the economy of the country and the end result of the work acts as a possible means of stimulating the drafting of stepped-up plans. The need to take into account when evaluating the activity of collectives not only the fulfillment of the plan, but also its level was indicated back in the decree of the CPSU Central Committee on the further improvement of the organization of socialist competition (1971). At the 25th CPSU Congress A. N. Kosygin noted that it is necessary to make the amounts of the economic stimulation funds at every enterprise and association directly dependent on the achieved results in the matter of increasing the intensification of production and labor productivity, of improving product quality and technical progress.¹

Thus, it can be said that the orientation toward a high level of production efficiency fundamentally also includes an orientation toward a high level of the plan assignments and develops into the higher synthesis of the level and the plan. It turns out that these approaches are not antipodes: the level creates an interest in a high plan, stimulates the mobilization in it of internal reserves; the plan, in turn, works for the level, comprehensively backing the balance of production with the necessary economic contacts. All this leads to the fundamental combination of the merits of the plan and cost accounting.

1. See "Materialy XXV s'yezda KPSS" [Materials of the 25th CPSU Congress], Moscow, 1976, p 132.

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The drive of clients for a reduction of the cost of the construction of new fixed capital and the operations on renovation and modernization will be stimulated under the conditions of stimulation for the end results of production. Indeed, if the cost of these operations was overstated and as a result the planned amounts of amortization for clients increased and the planned profit decreased, this would not entail the recognition of the allowed increase in price as a factor which should be eliminated when evaluating the activity of collectives and giving them incentives. The plan on the profit, perhaps, will be fulfilled, but the stimulation funds will nevertheless not come to the necessary amount. And, on the other hand, if the cost of new facilities decreases, the planned amounts of the amortization deductions are retained and the planned profit increases, the fulfillment of the plan according to this indicator will not lead to the leveling and redistribution of the profit will not hinder the increase of the stimulation funds.

Today, it is true, such a distant look ahead on the part of the client seems unrealistic. In practice the assignment to the balance of the client of practically any cost of a construction project predominates, since the latter in no way influences the amount of the future incentive funds. But if these funds depend on the value of the construction work, it can be hoped that the collectives will treat the expenditures on construction more strictly and will strive for an increase of the economic effectiveness of investments.

A similar situation arises in the area of the expenditures for raw materials, materials, fuel, power and components. Of course, when expensive raw materials are used in production, this must be reflected in the plan. However, given the former parameters of the output and, accordingly, the former wholesale prices for it such an increase of the embodied labor will inevitably lead to a decrease of the planned profit. And even though this plan indicator is achieved, the collective will not receive amnesty for the decrease of efficiency. Hence the stimulus to provide in the plan for the improvement of the economic indicators. It is possible, of course, that there are not enough raw materials with a low cost. Then the use of more expensive ones is not ruled out. But it is important that the collectives would be interested in ordering comparatively inexpensive raw materials and would attempt first of all to obtain namely them.

As to the use of manpower resources, their permissible number, structure and wage fund will be determined through the end result of production, and not subject to the number of people entered in the list of staff members.

If the collective begins to produce products of better quality and to update them rapidly in conformity with the new requirements with rational expenditures, by means of the absolutely increased (and relatively decreased) prices it will receive a comparatively larger wage fund than the collective, in which the quality of items is poorer and obsolete products are manufactured, despite the fact that the indicators of both the form and the latter collective conform to the plan indicators.

The adoption of the level method of evaluating the activity of collectives and stimulating them will also make it possible to intensify scientific and technical progress and specialization, to expedite the concentration of production and to establish more efficient economic contacts.

Under the new conditions the attitude of customers toward an increase of the prices of the goods being bought by them should be changed radically. Instead of the

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partially preserved aspiration of associations (enterprises) for high prices, which was connected in the past with the mechanism of evaluation according to the gross, the direct opposite aspiration--for a reduction of prices--will emerge. For an increase of the purchase prices for various goods will reduce the profit of the consumers, while their reduction will increase it. But the aspiration of producers to introduce high prices, by relying on their monopoly position, which results from the high concentration of production and the lack in a number of instances of other, parallel producers, will encounter a real counterforce in its way--in the form of the economic interests of the consumers.

The principle of level evaluation cannot be consistently implemented, if this level is taken into account only when forming the wage, the bonus and other material incentive funds, and is not taken into account when allocating capital investments, if the investments, as now, remain for the most part outside cost accounting financing. The combination of the level method of stimulation with the cost accounting financing of capital investments will ensure a sharp decrease of the deficit--both by means of the self-financing of a significant portion of the expenditures on expanded reproduction and by means of the reduction of the cost of the goods being produced and the output of additional products from the saved resources. The decrease of the demand for means of labor and manpower will eliminate their present influence on the increase of the deficit.

The fact that in the case of the level approach the participation of the masses in the management of production is more fully ensured, production democracy is developed and the effort of the collective is aimed at the drafting, fulfillment and exceeding of the stepped-up economic plans, is also significant. And the role of the managers of enterprises in this case increases, their responsibility for the results of production and for their own actions, which lead to a decrease or increase of the level of efficiency, is increased. The orientation toward the cost accounting results develops the creative forces of labor.

The economy of mature socialism has approached the point where it is opportune to raise the question of the evaluation and stimulation of collectives in conformity with the end cost accounting results of production. At the same time it is necessary to say with all certainty that the changeover to such a method of evaluation is among the most complicated socio-economic problems of the day. The point is that associations (enterprises) differ from each other in the scale of activity, their nature (custom, series, mass production), technical level, natural and transportation conditions, the profitability of the products being manufactured, raw material resources which are different in cost, the shift coefficient, the organization of labor and so on. Consequently the results of the labor of the collectives are so differentiated, that stimulation on the basis of the new principle can cause a mixed nature of revenues.

The question arises: Is it possible to consider this mixed nature to conform to the difference in labor achievements?

In our opinion, the levels of efficiency only in part reflect the differences in labor achievements, while in part they are determined by other factors which require elimination. External factors are usually ascribed to the latter. But far from all external factors distort the labor results and require elimination. For example, prices are an external factor (even if the association is the only producer

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of the product), which is governed by the centralized calculation of prices on the basis of the optimization of the expenditures and results for the entire national economy. At the same time the tendency was noted for a change in prices to influence the evaluation of the activity of collectives, and not to be excluded from it. The markups (discounts) on the prices for quality supplement the evaluation of collectives, and are not deleted, as ones which ostensibly distort it. This increases the interest of collectives in the study and controlled formation of demand and in its adequate satisfaction, for in this case the prices are at the most acceptable points for cost accounting.

Another external factor, which determines the level of efficiency, is centralized capital investments. They are allocated to associations (enterprises) in accordance with decisions of the state. But if investments are granted to one collective, but not to another, are given in one instance in a greater amount, while in another in a smaller amount, it is possible to consider as the first cause the fact that the collective, which got the advantage in resources, submitted the most profitable plan and in essence triumphed in the invisible sectorial and intersectorial efficiency contest. The increase of the output of new, more profitable items and the adoption of a processing method, which decreases the cost of production the most, as a rule, are behind the best plan.

In practice, unfortunately, something different also frequently happens, when investments are allocated not to the most efficient sphere. But this only contradicts the correct principles, requires the combatting of such phenomena and the appropriate revision of the economic mechanism and the system of responsibility of superior planning and financial organs and does not change the very nature of the centralized allocation of capital investments in favor of the best--from the point of view of society as a whole--places of their application. But as soon as this happens, the receipt of centralized investments when evaluating the activity of the collective should be regarded in a similar manner as the updating of items and the improvement of the technical base, that is, it should not be eliminated, but be reflected in the evaluation indicators. This is especially important as the financial sources of the investments are formed mainly from the revenues of the enterprise, the investments themselves require assimilation, additional work, while the results obtained by means of them to a considerable extent are centralized by the state. The matter is not always this way, but in those instances, when it is namely this way, it is legitimate to consider centralized investments as an external factor of work, which does not depend on the collective, but which should not be eliminated.

Along with the factors, which do not require, or more precisely do not always require, elimination when evaluating the activity of collectives, there are factors which indeed do merit a special approach. The task of attaching suppliers to customers is solved centrally, and it is necessary to eliminate the improvement or deterioration of the local indicators of efficiency, which arises as a result of this, by fixed payments from some enterprises and to adjust it by state grants in favor of others. The most important production mix, in which the profitability of individual items exceeds the average profitability, while in some instances it is, on the contrary, much less than the average, is specified from above. And here the local indicators of efficiency can be properly adjusted downward or upward by means of fixed payments or state grants, after which these indicators will be identified (according to the given factor) with the labor achievements of the collective. The amount of the material incentive fund of production associations (enterprises), which ensure the output of consumer goods, which have a relatively low profitability, as

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well as inexpensive goods, can also be increased by means of the reserve for the material incentive fund, which is created at the levels of industrial associations and sectorial ministries.

The differences in the profit of associations (enterprises) are caused in part by the different quality of the minerals being extracted, by the differentiation of the natural fertility of soils and the assets being additionally invested in the extractive sectors and by the uniqueness of the location of works with respect to the regions of the acquisition of raw materials and the marketing of finished items. The neutralization of the arising fluctuations of the profit is achieved by means of rent payments, when their amounts correspond to the difference in the objective factors.

The collectives have productive capital of different amounts and with dissimilar technical and economic characteristics. In order to eliminate the influence of these objective differences it is necessary to appraise the fixed capital at the prices of reproduction, which reflect the obsolescence and wear of the capital, and to exact from this value the full price for it. In order to level the different scales of credit resources it is required to subtract from the profit the interest on the loan, having established it with allowance made for the effectiveness of credits.

After adjustment of the level of the profit by means of fixed rent payments, the fee for capital and the interest on credits its further adjustment is seen in the contributions to the reserve funds until they are filled up within the limits of the norm. The standard economic stimulation funds are formed from the surplus of the profit. If assets remain in the profit after all the indicated deductions, in accordance with special uniform standards they must be divided between the incentive and development funds. A progressive tax should be exacted from the amount of the total incentive funds per worker. The amount of the incentive and development funds for the association (enterprise) as a whole, which is obtained in the end, forms its net profit. This amount also acts as a concrete expression of the level of production efficiency, as an indicator and source of the stimulation of the collective.

The above-standard portion of the development funds, as well as the reserve funds serve as centralized sources of state capital investments. Thereby self-financing is completely coordinated with the observance of national economic proportions (in case of a shortage of internal capital credit is drawn in an amount which corresponds to the difference between the national economic needs for the scale of development of the given works and the cost accounting potentials; the detailed characterization of this question goes beyond this article).

Interruptions of supply affect the amount of the profit. It happens that a collective works well, but the suppliers disrupt the deliveries of materials and components. In order to restore the profit of such a collective to the proper level the negligent suppliers must be forced to compensate for the harm done through their fault. Owing to the mechanism of proper sanctions, as well as the system of additional indicators, the nonfulfillment of which sharply reduces the incentive, the level evaluation will increase the responsibility of collectives not only for the adoption of stepped-up plans, but also for their fulfillment. Thus, it once again--now as viewed from the observance of the plan--will strengthen the principles of the planned management of the economy and will serve the plan.

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The level of the profit is very sensitive to prices. If these prices are less than the national economic impact of the products being produced or more than it, their comparison with the prices of the lower limit, that is, with those prices, below which the output of the given product becomes economically unprofitable to the producer, will reveal an understated or overstated profit. In 1978 the profitability in light industry in actually operating shops was equal to 25.3 percent, in the petroleum refining industry--24.8 percent, in the food industry--20.7 percent, in electric power engineering--6.7 percent, in the logging industry--1.2 percent; in the peat industry there was a loss of 0.7 percent, in the coal industry--3.2 percent. All this attests to how urgent the adjustment of current prices is, and in the case of the limitation of the latter the introduction of special correction factors.

Due to adverse weather in a number of regions of the country in 1978 the proper increase of the production of some agricultural products was not achieved. In 1979 as a result of weather difficulties the yield of grain, sugar beets and sunflowers was less than the average annual year in 1976-1978. Other factors, which it is impossible to put down to the credit of or to hold against labor collectives, can also influence the level of the results of production. For example, the worsening of the external economic conditions of fishing had the result that in 1978 for the Ministry of the Fish Industry the volume of sold products was 99.4 percent of the 1977 level, but since it was possible to foresee such a result, it was possible to take it into account in the plan, which as a result was fulfilled and even exceeded by 2 percent. In this specific case the evaluation according to the fulfillment of the plan reflected more accurately the results of the labor activity than the evaluation according to the achieved level. But already in 1979 the ministry was able in part to reorganize its work with allowance made for the new external conditions and increased the production volume with respect to the 1978 indicator by 5 percent. Under these normalized conditions the opportunity for a level determination of the results of production was again afforded.

In practice there are frequent instances when associations (enterprises) operate with a low shift coefficient as a result of a shortage of manpower resources, raw materials, power, the existence of bottlenecks and so on. At the final stages of production in a number of sectors--the chemical and light industry--the amount of material resources being received substantially limits the use of the production capacities. The level of the profit in such cases is comparatively low, but it is not always possible to blame the associations (enterprises) for this. In these situations and situations similar to them the limitedness of the profit should not be considered grounds for decreasing the stimulation funds, here an evaluation according to the plan, strictly in conformity with the specific conditions and the limited term of effect of this principle is again more advisable.

The level approach to the determination of efficiency, as we see, is raising very pointedly the questions of the breakdown of the labor results of production, the correctness of standard payments, prices, penalty sanctions and so on. And in this lies the main difficulty in the way of its adoption. The currently existing procedure in practice gets rid of these difficulties, for in essence it recognizes all factors as "independent" and owing to this the funds are distributed externally according to the most "just" method--in an equalizing manner. It seems that such a distribution does not offend anyone, but, if we look into it, it offends those who work well.

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During the initial period of the conversion of enterprises to the system of planning and economic stimulation, the adoption of which began in 1966, an attempt was made to use uniform (group, sectorial) standards of the formation of economic stimulation funds, in order to interest collectives in a high level of efficiency, since identical standards have the result that the resources of stimulation increase and decrease in direct proportion to the level of the evaluation indicators.

But the uniform standards were not backed by the appropriate system of payments, contributions. At many enterprises there were not enough raw materials and materials, a low shift coefficient of the equipment remained, there were bottlenecks which prevented the complete utilization of the production capacities. The differences in the technical level of production, which were far from completely leveled by the revaluation of the fixed capital, also prevented the use of uniform standards. For enterprises, whose indicators were inadequately high, the standards had to be increased. For those enterprises, whose indicators made it possible in the case of uniform standards to move ahead vigorously, they had to be lowered. Some standards were increased, while others were lowered until the stimulation funds per worker for the sector as a whole were equalized. Thereby the amounts of the stimulation funds basically returned to the initial level, while at the same time many negative attributes, which are characteristic of such an approach to stimulation, reappeared.

Strictly speaking, uniform standards of stimulation are not the ideal. At highly profitable enterprises the conditions may form for stimulation in excess of the level dictated by the uniform standards. In reference to enterprises with a low profitability the uniform standards are high, lower ones are required there. In the end it is necessary to strive not for uniform standards, but for higher ones for leading collectives and lower ones for collectives which work relatively worse, then the achieved results and standards will be precisely adjusted. Since, however, when giving incentives for the plan the standards are in inverse proportion to the level, as compared with such a system uniform standards are a major step ahead. They make the stimulation funds directly dependent on the achievements, although somewhat rigidly, with some discrepancy. In last place in stimulating effect are those individual standards, which in contrast to the evaluation, which corresponds completely or basically to the results, do not conform at all to them.

Although it is difficult to introduce stimulation for the level, life urgently requires the changeover to it. The beginning of this process was marked by the Model Method of Determining the Economic Effectiveness of Capital Investments and its development in the form of the Method (Main Principles) of Determining the Economic Effectiveness of the Use in the National Economy of New Equipment, Inventions and Rationalization Proposals, which require of designers the observance of the standards of efficiency, which are thereby transformed into the minimum permissible levels of return. But the principles of determining the economic efficiency of production at the stage of designing are realized by using analogous indicators at the stages of the construction and industrial operation of the built facilities--otherwise the consistent realization of these principles is impossible, disruptions of the unified cycle of obtaining the impact and dislocations between its phases, which are caused by the use of autonomous, uncoordinated criteria, are inevitable. Moreover, due to the metamorphosis of design indicators into planning indicators the clients relax the control over the work of the designers, who obtain an opportunity to show the impact with a great dioptric correction.

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In conformity with the Temporary Methods Instructions on the Changeover as an Experiment of Design and Survey Organizations to the New System of Planning and Economic Stimulation the designers receive bonuses for shortening the period of assimilation of the rated capacities, but here the assimilation of the technical and economic indicators is not taken into account. Therefore in the Method (Main Principles) of Determining the Economic Effectiveness of the Use in the National Economy of New Equipment, Inventions and Rationalization Proposals it is recognized as necessary that the indicators of the design effectiveness be carried over completely to cost accounting practice.

In connection with the use in cost accounting of incentives for the level of efficiency it is necessary to indicate the system of stimulation of the output of new goods for cultural and personal purposes and household use, in accordance with which during the first year of their series production the profit in the amount of up to 25 percent of the profitability remains at the disposal of the enterprises. The level principle of evaluation found expression here in the fact that uniform norms of stimulation depending on the level of profitability are set for all enterprises, regardless of the differences in their plan assignments.

A major milestone in the dissemination of the methods of stimulating collectives for the achieved level of efficiency was the granting to them in 1977 of the right to establish markups on the wholesale prices of practically all industrial consumer goods with the symbol "N" (novelty). Up to 15 percent of the temporary markups on the fixed wholesale and retail prices for high quality consumer goods are contributed to the material incentive fund of the workers, who took a direct part in developing the items of improved quality.

The markups for greater efficiency of new equipment, which gradually began to be applied to all highly efficient products for production engineering purposes were a further development of the price markups for quality. /The new decisions of the party and the government on the improvement of the economic mechanism envisage the extension of the price markups (reductions) for efficiency and quality to all goods for production engineering purposes/ in italics, which according to their parameters merit additional stimulation (penalization).

Since a specific proportion of the wholesale and retail prices is calculated with allowance made for the consumer impact, while the expenditures of enterprises should, as a rule, be incorporated in these prices, the very fact of an effect of the prices, which reflect the impact of the use of the goods, can with some conditionality be regarded as a level limiter of cost accounting expenditures. This is correct, in particular, with respect to the prices of the world market, which take the form of the upper limit of acceptability of internal production costs. Therefore, the greater the proportion of foreign trade is in the economy of a country, the more urgent the use of level criteria is for it. Otherwise too many export and import subsidies, for the payment of which there are not enough assets, will be needed. In this case individual state grants are used only at the first stage of foreign trade, then they are replaced by average ones, as a result of which the best enterprises gain advantages, while economic pressure is exerted on the worse ones. In Hungary since 1971 the differentiation of markups by enterprises has been replaced by their differentiation by subsectors.

From what has been said it is evident that today there are both incentives for the plan and incentives for the level. Stimulation for the plan predominates. At the

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same time analysis shows that the sphere of stimulation for the level is increasing, while the sphere of stimulation for the plan is decreased. In the future the continuation of the same trend is seen due to the adoption of the already mentioned uniform, as a rule, sectorial standards of pay and sectorial (subsectorial) or group standards of the formation of incentive funds. But much work still has to be done to adopt these standards. A transition period is required, during which the collectives will create for themselves the technical and other prerequisites of the use of uniform standards. It is necessary to envisage a system of temporary benefits in some instances and withdrawals of excessive revenues in others.

It is no less important to overcome the inertia of the individualized methods of stimulation. For even in the enforceable enactments, which set forth the procedure of planning wages and incentive funds for 1981-1985, the ministries are permitted to differentiate the standards of wages by associations, while the collectives, which are not approaching the conditions of groups, are permitted to use individual standards of the formation of incentive funds. Since the conditions, which permit differentiation, the methods of strict quantitative accounting of these conditions and the periods of their effect are not stipulated here, there is the real danger that the scope of the use of individualized standards of wages and the formation of incentive funds may be too broad and will be transformed from exceptions into the rule, which is reminiscent of the system, the improvement of which is stipulated by the new decisions.

For the purposes of stimulating stepped-up plans and high end results in the economy, apart from incentives for the level of efficiency, other methods are also being used. In order to aim collectives at the inclusion of reserves in the plan, and not at their above-plan mobilization, in 1965 it was established that the fulfillment of plan assignments is stimulated at the full standard, while the overfulfillment of them is stimulated at a reduced standard. In practice it turned out that those who adopted a stepped-up plan exceeded it by little and received incentives on the basis of a low planning standard (the higher the plan is, the lower--given the same amount of the incentive--the standard of its ratio is to the high planning indicator); those who adopted an unintensified plan, first, exceeded it greatly and, second, received incentives on the basis of a higher planning standard (in both instances the planning standard when the plan is exceeded, as was indicated above, was decreased). As we see, all the advantages were on the side of the latter.

Whereas the pluses from less stimulation of above-plan achievements are quite problematic, the minuses are clear. Hence it follows that it is hardly correct to stimulate any exceeding of the plan at reduced standards. Overfulfillment, which concerns little needed products, takes place, it really does not merit special stimulation. But overfulfillment of another type also takes place--for scarce products which society needs, the decisions of the party and the government are oriented toward such overfulfillment. Although the overfulfillment of the plan in this case is necessary, an obstacle arises here--a reduced incentive. The rate of overfulfillment of the plan is being checked, some useful measures are not being implemented immediately and are being postponed to the following year.

Let us note that, in accordance with the new decisions, the gap between the stimulation for the fulfillment and the overfulfillment of the plan indicators is being decreased. With the overfulfillment of the plans on the profit by up to 3 percent half of the above-plan profit is left to the disposal of the industrial ministry

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(association, enterprise): beyond the indicated mark the proportion of the profit left to the producers is decreased to 25 percent.

The principle of planning according to the base has been used for a long time for defeating the attempts of some collectives to set too low the plans on production and the profit and to set too high the wage funds, the capital investments, the expenditures on raw materials, materials and others. For this purpose the dynamics for recent years of the main economic indicators are determined for each association (enterprise), the corresponding average annual value is arrived at, which then, with adjustments for the conditions of the planning year, is transformed into a new assignment, below which the plan is not approved. Such a technology of planning provides plan assignments at a level no worse than the base period and performs the role of the minimum compulsory "press," but it also has its weak points. Those collectives, which retained concealed reserves during the base period and did not include them in the new plan, are under better conditions than those collectives which did not have such reserves or adopted a stepped-up assignment.

In trying to interest associations (enterprises) and ministries in stepped-up plans, some economists suggested that economic stimulation funds should increase in a certain proportion to each percentage of the increase of the evaluation indicators, for example, should increase with each percentage of the growth of sales or labor productivity. However, a large increase of sales can also be obtained by means of the excessive outlay of investments and the enlistment of significant numbers of workers. As a result its increase will be combined not with an increase, but with a decrease of the intensity of the plan. There is also no identity between the intensity and the increase of labor productivity. This indicator does not reflect the degree of utilization of production capacities and, moreover, objectively prompts collectives toward a low rate of development. For instance, a plant planned to increase production by only 2 percent--this can be achieved without increasing the number of workers, and then the indicator of the proportion of the increase of production due to the increase of labor productivity will approach 100 percent. If an increase of production by 20 percent is planned, the collective cannot do without new workers, and then the proportion of the increase of production due to the increase of labor productivity will decrease, in which the collective is not at all interested, although this solution conforms to national economic interests. Such difficulties arise in the process of the improvement of product quality, which requires an increase of the labor-intensity.

There is the opinion that the intensity of the plan should be determined according to the utilization ratio of the production capacities. If we agree with this opinion, the collectives with old capacities, which were assimilated long ago, will be the leaders. This will stimulate plants to reject renovation, the construction of new shops and the adoption of an advanced manufacturing method, which initially decreases the utilization ratio of the capacities.

The elaboration of a system of standards of intensity, which include the utilization ratio of the production capacities, the coefficient of the decrease of expenditures on materials, the utilization ratio of working time, the correlation between the factors of extensive and intensive growth and others, has begun in order to overcome the incompleteness of some criteria of the evaluation of the intensity of the plan. The values of these standards are compared with the plan assignments: if the planning indicators are worse than the standard indicators, the deviations are considered as a sign of insufficient intensity of the plan. But the stepped-up plan is

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not an assignment with maximum values of the utilization of all production factors, but an assignment, in which these factors are best combined, in which the maximum end, overall result is achieved.

Subjectivism in determining the measures of stimulation for one indicator or another of intensity also belongs to the shortcomings of the present methods of stimulating stepped-up plans. This subjectivism takes the form of the absence of a direct link between the efficiency from the increase of intensity (the sources of the reward), on the one hand, and the established standards, on the other. As a result the incentive can be first undeservedly great, then undeservedly small.

Apparently, it is not by chance that in the Main Statutes on the Formation and Expenditure of the Material Incentive Fund and the Fund for Sociocultural Measures and Housing Construction (Incentive Funds) During 1981-1985 in Industry there is no mention of the establishment at the stage of determining the control figures for the five-year plan of standards of the incentive funds with allowance made for the intensity of the plan assignments. Meanwhile in earlier instructions of the same type there were similar recommendations.

It seems that the changeover to the stepped-up plan should be based not so much on the finding of special indicators of intensity as on stimulation for the level, which creates a stimulus to achieve the highest production results. When these stimuli have been created, the decisions of the party and the government on the improvement of the economic mechanism have been fully implemented and their letter and spirit have been consistently carried out, truly stepped-up plans will appear of their own accord. The increase of the intensity of plan assignments--of course, a scientifically sound, realistic increase--is the most important reserve of the increase of production efficiency at the present stage, the mobilization of which is necessary for the quickest possible solution of the urgent socio-economic problems of our society.

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UTILIZATION OF RESOURCES AND SUPPLY

ASSESSING ECONOMIC VALUE OF NATURAL RESOURCES

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[Article by N. Feytel'man]

[Text] At the June (1980) Plenum of the CPSU Central Committee L. I. Brezhnev said: "Maximum energy--and this should be emphasized--needs to be dedicated to successful fulfillment and overfulfillment of the plan for the final year of the 10th Five-Year Plan, to activating projects scheduled for completion on time, and to ensuring the steady effort of the national economy in 1981--the first year of the 11th Five-Year Plan."

Maximum energy is needed to seek out and utilize internal production potential and to further reduce materials intensiveness by reducing losses and by optimizing the use of natural resources.

Optimizing the exploitation of natural resources makes it indispensable to assess the economic value of natural resources. There are different types of assessments--engineering, technological, geological, and economic. The economic assessment is the most general type.

The problems of economic assessment of natural resources have been widely discussed in the economics literature.¹ In the period of carrying out the decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" the urgency of the problem of economic assessment of natural resources and of its use in practice has been increasing substantially. According to the decree, USSR ministries and departments and councils of ministers of union republics are to draft plans of projects for natural conservation and environmental protection and to adopt them as part of 5-year plans so that plans of economic and social development will incorporate all aspects of the advances of science and technology.

Strengthening the influence of the economic mechanism on increasing production efficiency and work quality presupposes improvement of the cost-accounting (khozraschet) foundations of the conservation and optimum use of

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natural resources, which in turn is impossible unless their economic value is assessed. Finally, to increase the efficiency of social production the assessment of national resources must be incorporated into the system of economic calculations, since production is a process whereby nature and society interact and natural resources are the basis in nature for production and the creation of material goods that become part of the national wealth.

Yet the existence of a number of debatable issues in the principles governing the method of economic assessment of natural resources (the cost and rent conceptions, determination of the less favorable natural resource and the principles governing its assessment, the specific nature of assessment of mineral resources, taking the time factor into account, etc.) is making it more difficult to use the economic assessment in the drafting of plans and projects and in carrying out planning decisions.

All the principles of methods and methodology concerning economic assessment of natural resources can be brought together under two basic conceptions: assessment of natural resources must be based on the socially necessary expenditures of labor to develop them and prepare them for exploitation; in assessment of natural resources one's point of departure must be a capitalized differential rent.

S. Strumilin, member of the academy, in whose writings the cost conception has been developed most fully and consistently, taking into account that the valuation of better land that is easier to develop turns out to be lower than that of worse land whose development necessitates sizable outlays, proposes that in assessment of specific plots of land the point of departure be the yield on the given plot and current production costs,² that is, he is in essence shifting toward the second conception.

The proposal that natural resources be assessed on the basis of capitalization of differential rent has been better argued from the standpoint of theory and methodology (T. Khachaturov and N. Fedorenko, members of the academy, K. Gofman, M. Loyter, etc.). This conception is based on the influence which natural factors have on the level of labor productivity. Consequently, additional profit can be obtained in the exploitation of natural resources characterized by more favorable natural conditions and factors.

As we know, economic or natural factors which can be accessible in a given period of time only to a particular group of enterprises and economic entities are a reason for formation of additional profit. More favorable economic factors of production are in most cases the product of previous labor. They are renewable and consequently accessible to every socialist enterprise, but for a given enterprise (or group of enterprises) they are temporary. More favorable natural factors affecting the level of labor productivity are nonrenewable and therefore are by nature constant and stable.

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The difference in the economic nature of man-made and natural factors affecting the level of labor productivity predetermines a difference in the forms of additional profit. The additional profit based on more favorable man-made and renewable factors of production is temporary in nature and can be obtained at all enterprises of a given sector or industry and in all sectors of the national economy. The additional profit obtained as the result of economic exploitation of more favorable natural factors of production takes place only in the extractive industries, in the timber and lumber industry and in agriculture. In the context of the Marxist labor theory of value natural resources possess a value if labor has been involved in their creation. K. Marx noted that capitalized land rent, which forms the value of land, is an irrational category, "since the land is not a product of labor and consequently does not have value."³ But he acknowledged that "the fictitious form of the price--for example, the price of land which has not been cultivated and has no value since no human labor has been embodied in it--may conceal in itself a real value relation or relation derived from it."⁴ And he goes on: "Land ownership pertaining to a waterfall does not in and of itself have anything to do with the creation of surplus value (profit), nor therefore anything to do with the price of the good produced by means of the waterfall. This additional profit would come about even if there were no land ownership at all..."⁵ In the context of socialist production it takes the form of the differential rent. This has resulted from the independence of socialist cost-accounting enterprises in the context of the socialist state's monopoly ownership of the land and its resources.

The right of socialist enterprises to use land and minerals and the principles of full cost accounting should be regarded as a specifically socialist form of monopoly over land and minerals as an object of economic exploitation. The existence of two forms of monopoly over the land and minerals in the context of the relatively limited nature of natural resources has led to the transformation of the additional income into a differential rent.

If a plot of land (deposit or the like) is compared to a less favorable one, we take into account only the influence of the natural factors on labor productivity and assume full comparability in socioeconomic factors and factors of production. The majority of natural resources put to economic use fall under the head of means of production. For instance, mineral resources, which at present account for more than 70 percent of the output of the extractive industries, and specifically coal and iron were described by V. I. Lenin as true "'means of production' for means of production."⁶ Examining the question of the influence of the productivity of machines on the economy of labor, K. Marx noted that this economy is equivalent to the level of productivity of machines: "The productivity of a machine is measured by the extent to which it replaces human labor power."⁷

On the basis of what we have said it seems to us that T. Khachaturov, member of the academy, was on sound methodological ground when he proposed his definition of the economic assessment of natural resources on the basis of

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capitalization of differential rent: "The differential rent is the benefit from exploitation of a resource of higher quality; this benefit is expressed in higher labor productivity. Here the well-known similarity with more refined means of labor obtains: the benefit obtained from their use is also manifested in higher labor productivity, and it is this which justifies their use, which necessitates capital investments."⁸

Knowing the benefit to be derived from exploitation of more favorable natural factors (differential rent--R) and provisionally setting it equal to the comparative benefit from exploitation of more productive means of production, which is regulated by the coefficient of comparative efficiency of capital investments (E_H), we can roughly arrive at an economic assessment of natural resources (S) with this formula⁹

$$S = R/E_H. \quad (1)$$

Computation of the differential rate involves determination of a natural resource characterized by relatively less favorable natural conditions and the level of marginal costs which comprise the socially justifiable limit of expenditures under the assumption that the needs of the national economy for the given type of natural resources are met. The level of marginal costs is affected by technical progress, which generates a tendency to reduce them, and the ever broader range of natural resources being drawn into economic exploitation, which generates an opposite tendency as a consequence of greater differentiation of costs. Computing the resultant of these two opposing tendencies is one of the principal problems in planning and forecasting, and solving it makes it possible to establish the marginal costs for the period under consideration.

Marginal costs can be established not only for the country as a whole, but also for particular regions and zones and also for deposits as a function of the scale of production and location of enterprises in the extractive industries, differences in natural conditions and the resulting differentiation of costs and shipping expenses. Moreover, the level of marginal costs of a given natural resource can be established as a function of the character of problems in planning projections and economic problems in whose solution they are used (for example, determining the sequence in which deposits are to be developed and the date for cessation of exploitation of worked-out deposits).

World prices of natural resources, which have a high share in our country's export-import operations, must be taken into account in determining the level of marginal costs. The planned ceilings on marginal costs are based on the data of the state plan. Calculations of the differential rent are best applied to the same period for which the given levels of marginal costs are established. Here we should bear in mind that the marginal costs have a limited sphere of application; they are used at present only to determine the economic value of natural resources.

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The specific nature of economic assessment of mineral resources (as compared to other types of natural resources) results from the nonrenewability and relatively limited nature of reserves of minerals at any deposit, from the determinacy of their quality characteristics and the geographic and mining-geological conditions of their location. Realization of the differential rent in agriculture cannot be carried over from one year to another, while the value of the mining rent to be realized is mediated by the size of the given deposit's mineral reserves. When plots of land are used, it is possible to select the farm crop that is most productive under the given conditions. This choice does not exist in the mining industry. There can only be a difference in the completeness of extraction of the given mineral and accompanying components.

Studies of changes in costs of extraction (taking into account deductions for geological exploration work), for primary processing and for shipment of various minerals to the consumer pertaining to the entire period of exploitation of a number of deposits show that the size of the annual mining rent and also the mining rent per ton of production changes over the entire period the deposit is worked. It changes under the influence of the variation of the cost of extracting and enriching the given deposit's mineral (which results on the one hand from the impact of scientific-technical progress and on the other from change in the mineral's quality and the conditions of its location, and so on), shipping expenses and the level of marginal costs.

The period of time in which the favorable economic factors are operative and the receiving of the differential rent are in a number of cases shorter than the period deposits are worked. As a consequence in the last period a deposit is worked¹⁰ the mining costs may rise to the level of the marginal costs for that region, basin or industry as a whole. As a rule stages of intensive working of deposits are related to the operativeness of more favorable natural factors. Thus the differential mining rent occurs at almost all deposits, but the time over which it is obtained differs: it may be equal to the entire period the deposit is worked or may be limited to particular stages in that period.

What we have said above gives rise to the need to make specific computations to determine the average annual value of the mining rent (\bar{R}_{CP}), which is computed as follows: for newly opened deposits to be put under exploitation--by dividing the total amount of mining rent which can be obtained from the deposit over the entire period it is worked, regardless of how long the favorable natural factors are operative, and for deposits being worked--by dividing the total amount of the mining rent over the remaining years of exploitation by the period remaining for working the deposit.

The calculation is made with the following formulas:

$$R = R_T/T \quad (2)$$

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$$R_T = \sum_{t=1}^T R_t \quad (3)$$

in which R_T --total amount of mining rent which can be obtained from the deposit over the entire or remaining period it is worked (in rubles); R_t --mining rent in the t -th year of working the deposit (in rubles); T --period of time the deposit is worked; t --computational period used in evaluating the deposit (excavation unit), which is counted from the year the assessment is made ($t_1 = 1$) to the year when the working of the deposit ceases ($t_T = T$).

The question of the legitimacy of taking the time factor into account in determining R_T is a matter for discussion. In our opinion this artificially reduces the level of the average annual mining rent (R) by comparison with the level of the average annual rent used to evaluate natural resources of other kinds (land), for instance) and consequently lowers the level of the value assigned. The time deposits are worked runs into decades, whereas discounting is used mainly in comparative computations of short-term capital investment programs for stimulating reduction of construction time. Use of the discounting method in computing the total amount of mining rent in order to determine its average annual amount, to be used for assessing the economic value of deposits, results in an unjustified reduction of reserves on the balance sheet and an absolute majority of sites¹¹ and reduction of cost-accounting incentives of mining enterprises with respect to optimum utilization of the mineral potential.

In discussing the specific nature of assigning an economic value to mineral resources we should note that reserves of minerals are renewable at each deposit and the existence of the natural basis and material foundation of the mining rent terminates with their exhaustion, whereas the possibility of using land in agriculture is not limited in time (providing proper soil and crop practices are followed, the fertility of the land can even be increased over time). But it does not follow that in economic assessment of minerals we need to use different methods for capitalizing the differential rent than in economic assessment of other natural resources (for instance, land).

Geological explorations and development of the mining industry have a large impact (direct and indirect) on the environment and on natural resources. There is a direct impact since one can trace the direct effect which the mining industry has on other natural resources and the environment: land, timber, the water and air. There is an indirect impact since development of the region commences often with the working of mineral deposits. More than 700 new cities and settlements of the urban type have been created in the years of Soviet power as a result of development of known and prospected mineral deposits.¹²

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The question of evaluating less favorable natural resources is still a matter for discussion. It seems to us that in this case we should use the cost conception. But it must be a question not only of assessment, but also of price. The price of the less favorable natural resources is determined by the costs of their development, their exploration and prospecting. It is advisable to distinguish these categories: economic evaluation of natural resources proper and the price of the products of labor in the primary branches of material production (the primary industries in which nature is directly exploited)--the extractive industries, agriculture and timbering.

The economic valuation is determined on the basis of capitalizing the differential rent, that is, capitalizing the surplus over the average profit obtained in exploiting the resources with comparatively more favorable natural conditions and factors. The labor expended to develop plots of land and to explore and prospect minerals is productive labor and creates value. The value and its money expression--the price--reflects the expenditures of live and embodied labor incurred in discovering and developing the given natural resources, but not a valuation of the natural resources proper. The items used in the price calculation must include outlays to exploit natural resources and must be included in the production cost and price of the product of the respective primary production industries.

For instance, prospected mineral deposits can be regarded as the finished product of one of the branches of the material sphere--geological exploration. Consequently, their price is determined by the socially necessary expenditures of live and embodied labor for geological prospecting work.

The price of deposits prepared for exploitation and rigged up, as well as of deposits which are in differing stages of exploitation is computed on the basis of the socially necessary expenditures for geological prospecting work, for rigging up the deposit and preparing it for exploitation, taking into account productive capital, which is assessed at its replacement cost. The economic value of deposits characterized by more favorable natural conditions is included in the cost as the additional portion of profit.

Assigning an economic value to natural resources makes it possible to register more fully the size and composition of the national wealth and makes it easier to develop a cadastre of natural resources which must not only record the condition of resources, but also provide a description that makes it possible to judge their suitability for meeting the needs of the national economy and for supplying natural resources in the future.

Economic assessment of natural resources is also very important to improving forecasting and multiannual planning and to the drafting of comprehensive scientific-technical, economic and social programs. Use of the economic assessment of natural resources in the actual drafting of plans will make it possible to resolve more soundly the questions of diverting farmland for nonagricultural purposes, selection of an efficient system of working

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deposits, the advisability of creating reservoirs and of setting aside areas they will occupy, and so on.

Introduction of indicators of national economic efficiency of geological explorations into plan-drafting and economic practice will make it possible to considerably strengthen the influence of the economic mechanism on increasing the quality of geological exploration and will tend to bring cost-accounting and national economic interests closer together. The national economic efficiency of geological exploration is assessed by the value which exploitation of the given deposit has to meeting the needs of the national economy.

By contrast with the extractive industries, the size of outlays for geological explorations does not depend on the quality of the raw minerals, the location of deposits and the proximity of areas of consumption. The indicator of specific costs of exploration and prospecting per unit of reserves prospected by commercial categories characterizes the results of the economic and financial activity of the geological prospecting enterprise at the given promising area or deposit. It is determined by the volume and quantity of performance of the geological assignment, by the expenditures for the geological prospecting work done in this connection, and it is used to compute the economic efficiency of geological prospecting for the entire industry. But use of this indicator does not afford the possibility of evaluating the factors that characterize the economic value of the deposit to the national economy nor the advisability of exploring it and preparing it for exploitation in the period covered by the plan.

The main problem in computing the efficiency of geological exploration work is to discover the significance of the deposit to the national economy, the advisability of appropriating funds to explore it and prepare it for exploitation.

We share the view that it is wise to determine the efficiency of geological prospecting to the national economy in terms of the ratio of the economic valuation of deposits to the aggregate amount of outlays for geological prospecting and capital investments to develop the deposit.¹³ It is especially problematical to establish forecast reserves, which are the result of discovering new deposits and strata. Moreover, forecast reserves, which are distinguished by low reliability, must exceed commercial reserves several times over. But at times in order to fulfill assignments for the growth of reserves in commercial categories exploratory (poiskovyye) work in a number of areas is partially replaced by prospecting (razvedochnyye) work. As a consequence promising structures are unsatisfactorily prepared for prospecting work, prospecting work takes more time and the specific cost is higher, geological prospecting projects are scattered over a large number of structures and the degree of their promise is not sufficiently taken into account, and as a consequence deposits which are unprofitable for future exploitation are transferred to the balance sheet of prospected resources.

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Increasing the efficiency of capital outlays is achieved above all by concentrating capital investments and efforts on the most productive and conveniently located deposits. That is why determining the economic value of deposits and the national economic efficiency of geological prospecting is best done in an early stage of their performance. This opens up the opportunity of avoiding premature prospecting of deposits which will not presumably be worked in the future because of the unprofitability of exploitation and as a consequence to concentrate funds on the prospecting of promising deposits which will have to be brought under exploitation to meet the needs of the national economy and for which this has been envisaged by the plan.

The unprofitability of national economic use in the future is not the only reason why prepared deposits wait a long time for commencement of exploitation. Another reason is the discrepancy between the outlays for geological prospecting work and capital investments in the mining industry. Because plans for detailed prospecting are not adjusted to plans for the mining of mineral resources, in multiannual plans of geological prospecting provision is frequently made for detailed prospecting of deposits whose development (after completion of prospecting work) cannot be begun by the industry because it does not have the necessary funds, because the production and non-production infrastructures have not been prepared, or because the consumers are lacking. This indicates the advisability of ensuring greater balance in development of geological prospecting in the mining industry, between plans for the development of these industries and plans for development of regional industrial complexes. Plans for geological prospecting need to be drafted as an organic part of comprehensive plans for development of the respective mining industries and comprehensive plans for economic development of each region.

The method based on the factor relating the prospected reserves to mining is most widely used to determine the national economy's need for raw minerals and fuel. Prospected reserves must be adequate for the planned and forecast amount of mining, taking into account the necessary time lag. At the same time an excessively high supply of reserves prospected by commercial categories results in an unjustified expenditure of labor, physical and money resources; yet a low level of supply holds back development of the mining industry and as a consequence the development of the national economy as a whole (leaving aside foreign trade).

It would seem advisable to create reserves of raw minerals and fuels to last many years mainly on the basis of exploratory work and preliminary prospecting. The question of the time when the deposits would be subject to detailed prospecting should be settled at the same time when the prospective plan for working them is compiled. It would then become possible to link the various stages and phases of the work so as to reduce the time lapse between the prospecting of the deposit and its commercial development. In a number of cases it might be possible to begin preparatory work for commercial development, to lay roads, to build production buildings and

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housing and power stations even before prospecting of the deposit has been completed if the deposit has been assigned a high economic value. In the final analysis there is a sizable saving on funds for construction of housing for prospecting workers, personnel are kept on and trained for the future mining enterprise, and this affords the possibility of quickly bringing the prepared reserves under exploitation. In this connection it is obviously advisable to transfer the detailed prospecting of certain minerals to the jurisdiction of the respective ministries of the extractive industry, which would make it possible to eliminate the disproportion between detailed prospecting and current mining and also to ensure concentration of attention of the USSR Ministry of Geology on exploratory work, on improved preparation of structures for prospecting and on the problems of conservation of natural resources. This could be furthered by establishing direct cost-accounting relations between the geological prospecting service and the extractive industry by transferring deposits which have been prospected to the balance sheet of the mining enterprises along with the respective valuation, which will make it possible to strengthen the economic stimulation of geological prospecting organizations to reduce work in process and to concentrate funds on prospecting the deposits which are more suitable for exploitation.

It is also indispensable to improve the system for financing geological prospecting. At the present time these efforts are financed both from the budget and also at the expense of capital investments. The existence of two sources of financing results in a division of the plan for geological prospecting into two parts and is one of the reasons for the wasting of funds, for the large time lapses between the various phases of the work, and for lax monitoring of fulfillment of the plan for exploration and prospecting of deposits. Yet outlays for geological prospecting are in their economic essence capital investments in mining industries. To finance them from the operational funds of the state budget distorts the actual amount of expenditures of social labor to meet the need for the particular type of raw mineral and is not conducive to more purposive and efficient use of those funds. Attention should therefore be paid to the proposals to plan appropriations for geological prospecting as a part of capital investments to develop the mining industries, a separate line being devoted to them. Thus prospected reserves of minerals are given an estimated value, which would make it possible to use them more optimally and to create additional prerequisites for establishing direct cost-accounting relations between geological prospecting and the mining industry. It would also be wise to envisage possible directions in which geological prospecting organizations might use bank credit after the pattern of capital construction.

The decree of the CPSU Central Committee and USSR Council of Ministers dated 12 July 1979 has paid much attention to ensuring optimum utilization of natural resources. Reduction of losses of mineral resources in mining is assuming particular importance in this connection, since mineral resources are by definition nonrenewable; the level of the capital-output ratio in mining the most important types of minerals is as a rule considerably

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higher than in the respective operations where the raw minerals are processed (nearly fourfold in the case of petroleum, more than twofold in the case of metallic ores, and twofold in the case of chemicals).¹⁴

At the present scale of mining and processing of minerals, a saving of only 1 percent of the raw minerals and fuel would be equivalent to bringing into the sphere of production an additional 2 million tons of iron ore, about 5 million tons of petroleum, about 5 million cubic meters of natural gas, almost 7 million tons of coal, and so on. Losses of potassium salts underground at the Starobin Deposit in Belorussia, for example, amounted to 260 million tons when 170.4 million tons were mined, which is more than 60 percent of the balance-sheet reserves of this valuable type of mineral resource taken off the books.¹⁵

But these losses are not reflected in the technical-and-economic indicators of the performance of mining enterprises. Reduction of the losses of mineral resources underground is not only a technical problem, but also an economic problem. It can be solved above all by improving the existing systems of working deposits and by introducing progressive new ones, by introducing new technology and processes, by building enterprises specialized in processing and utilizing accompanying components. Solving this problem requires additional outlays, whose economic efficiency often cannot be justified because of the lack of a money value assigned to the mineral resources. As a result new methods and progressive systems of mining are being introduced slowly, and mining enterprises do not have sufficient economic motivation to make use of them.

A sizable share of the losses of mineral resources underground is related to inadequate utilization of accompanying components. The steady increase in the need for mineral resources is bringing under exploitation deposits which have a low content of the mineral. For instance, at iron deposits in 1950 the raw ore had a 50-percent iron content, in 1960 it was 44.5 percent, in 1970--37.3 percent, and in 1980--35.1 percent.¹⁶ The drop in the content of the principal mineral has the following results:

- i. an increase in the extraction of material per ton of the mineral. For instance, the amount of raw ore per ton of iron in commercial form increased 1.3-fold (from 2.6 to 3.3 tons) between 1966 and 1977. In 1977 1.3 billion tons of material were extracted in iron mining; 37 percent of this material was raw ore, 19 percent was commercial ore, and 11 percent was iron in commercial form;
- ii. the capital intensiveness of mining increases. For example, specific capital investments to increase the production of raw iron ore increased during the 10th Five-Year Plan to 102 rubles per ton as compared to 61 rubles per ton in the Eighth Five-Year Plan;¹⁷
- iii. a greater impact is exerted on the environment and costs of its protection increase. The costs of transporting the waste and maintaining

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tailings represent about 8-10 percent of the production cost of commercial ore.¹⁸

The amount of material mined can be reduced by utilizing it more fully. There is hardly any deposit which has only one mineral component. For instance, iron ores contain more than 10 accompanying mineral components (vanadium, cobalt, copper, germanium, phosphorus, sulfur, tantalum, niobium, zirconium and titanium), whose reserves have particular importance to the national economy. But at the present time only 7 of the 53 iron mining enterprises in operation are working their deposits thoroughly.¹⁹ In order to increase the economic motivation for comprehensive working of mineral deposits it would be wise to determine the economic value of deposits so as to take into account reserves not only of the principal component, but also those of accompanying components.

Transferring prospected deposits to the balance sheet of mining enterprises at a price that includes the respective economic valuation must be introduced gradually, for certain types of the minerals for which there is the greatest shortage, so as not to cause a sharp rise of prices. It should also be taken into account that use of the economic valuation of natural resources in the practice of the national economy strengthens cost-accounting incentives for optimum exploitation of natural resources and ultimately ensures a reduction of losses of natural resources, a drop in the materials intensiveness of social production, lower production cost and lower prices for the product of extractive industries.

But we should also not exaggerate the importance of the economic valuation of natural resources. This is only one of the indicators making it easier to solve the problem of strengthening economic incentives and increasing the national economic efficiency of their utilization. In the practice of planning and of carrying out planning decisions and in the drafting of comprehensive target programs this indicator can be used only in conjunction with other technical-and-economic and social indicators and characteristics such as the production cost and profitability of production, the existence and intensiveness of utilization of fixed capital, the existence of a prepared production and nonproduction infrastructure, of qualified personnel, the existence of consumers, the costs of environmental protection, the national economy's assured supply of the particular type of natural resource in the future, etc.

On the whole use of the economic valuation of natural resources in planning and national economic practice should serve the task of strengthening the influence of the economic mechanism on increasing the social and economic efficiency of exploitation of natural resources.

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FOOTNOTES

1. See S. G. Strumilin, member of the academy, "Toward Assessment of the Gifts of Nature," "Izbrannyye proizvedeniya" [Selected Writings], Vol I, Izdatel'stvo Nauka, 1964; T. S. Khachaturov, member of the academy, "Sovetskaya ekonomika na sovremennom etape" [The Soviet Economy in the Present Stage], Izdatel'stvo Mysl', 1975; T. S. Khachaturov, member of the academy, "Intensifikatsiya i effektivnost' v usloviyakh razvitogo sotsializma" [Intensification and Efficiency in the Context of Advanced Socialism], Izdatel'stvo Nauka, 1978; T. S. Khachaturov, member of the academy, "Effektivnost' kapital'nykh vlozheniy" [Efficiency of Capital Investments], Izdatel'stvo Ekonomika, 1979; N. P. Fedorenko, member of the academy, "Aktual'nyye problemy ekonomicheskoy teorii" [Current Problems of Economic Theory], Izdatel'stvo politicheskoy literatury, 1973; "Vremennaya tipovaya metodika ekonomicheskoy otsenki mestorozhdeniy poleznykh iskopayemykh" [Temporary Standard Method of Economic Evaluation of Mineral Deposits], USSR State Committee for Science and Technology and USSR State Committee for Prices, Moscow, 1980; K. G. Gofman, "Ekonomicheskaya otsenka prirodnnykh resursov v usloviyakh sotsialisticheskoy ekonomiki" [Economic Evaluation of Natural Resources in the Context of a Socialist Economy], Izdatel'stvo Nauka, 1977; M. N. Loyter, "Prirodnyye resursy i effektivnost' kapital'nykh vlozheniy" [Natural Resources and the Efficiency of Capital Investments], Izdatel'stvo Nauka, 1974; and also see the discussion in the journal VOPROSY EKONOMIKI in the 1967-1969 period.
2. S. G. Strumilin, "On the Price of the 'Gifts' of Nature," VOPROSY EKONOMIKI, No 8, 1967, p 60.
3. K. Marx and F. Engels, "Sochineniya" [Works], Vol 25, Part II, p 172.
4. Ibid., Vol 23, p 112.
5. Ibid., Vol 25, Part II, p 198.
6. V. I. Lenin, "Polnoye sobraniye sochineniy" [Complete Works], Vol 1, p 100.
7. K. Marx and F. Engels, "Sochineniya," Vol 23, p 402.
8. T. S. Khachaturov, "Intensifikatsiya i effektivnost' v usloviyakh razvitogo sotsializma," p 289.
9. Ibid.
10. In the first 1-3 years of working deposits mining costs may be higher than marginal costs, but this period should not be used in making the economic assessment of deposits, but should be regarded as the period for development.

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11. Ye. A. Kozlovskiy, "The Mineral Raw Materials Base and the Time Factor," SOVETSKAYA GEOLOGIYA, No 3, 1979, pp 9-22; A. Ya. Kats, "Method of Taking Into Account the Time Factor in Drafting Specifications for Raw Minerals," SOVETSKAYA GEOLOGIYA, No 9, 1979, pp 12-18.
12. A. V. Tomashevich, "Ekonomicheskaya otsenka mineral'nykh resursov Belorussii" [Economic Evaluation of Belorussia's Mineral Resources], Minsk, 1978, p 11.
13. Yu. A. Sokolovskiy, "Certain Aspects of Determining the Economic Efficiency of Geological Prospecting Efforts," SOVETSKAYA GEOLOGIYA, No 7, 1979.
14. VOPROSY EKONOMIKI, No 7, 1979, p 68.
15. A. V. Tomashevich, "Ekonomicheskaya otsenka mineral'nykh resursov Belorussii," p 45.
16. A. Tselikov, "Conservation of Metals Through New Technology," PLANOVOYE KHOZYAYSTVO, No 8, 1979, p 56.
17. Ibid.
18. M. Sergeyev, "The State Approach to Utilization of Secondary Resources," EKO, No 8, p 51.
19. EKONOMIKA I ORGANIZATSIYA PROMYSHLENNOGO PROIZVODSTVA, No 8, 1979, p 54.

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INTRODUCTION OF NEW TECHNOLOGY

METHODS OF WEIGHING BENEFITS OF NEW TECHNOLOGY REVIEWED

Moscow VOPROSY EKONOMIKI in Russian No 10, Oct 80 pp 37-45

[Article by L. Kachmazova, Ordzhonokidze: "Managing the Efficiency of New Technology"]

[Text] Successful performance of the tasks of our country's socioeconomic development necessitates a further rise in the efficiency of social production, which is the determining factor in economic growth.

Speaking at the June (1980) Plenum of the CPSU Central Committee, L. I. Brezhnev noted: "We have set ourselves the fundamental task of raising the efficiency of production and the quality of performance. It must be constantly before us."¹ The future rise of production efficiency is largely dependent upon speeding up scientific-technical progress in the national economy and upon reflection of its consequences in a real rise in the technical level of production.

The decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" directs a system of measures at application of scientific-technical advances, at raising the growth rates of labor productivity, at improvement of product quality, and at all-out conservation of all forms of resources. That program embraces the main directions for improvement of planning, economic instruments and incentives for speeding up technical development of production, including the mechanism for formation and utilization of the production development fund, the unified fund for development of science and technology and the material incentive fund, enhancement of the role of credit, the charge on capital, the price, and standards governing remuneration, and so on. Thus speeding up scientific-technical progress and raising production efficiency involve the performance not just of individual measures, but of a set of interrelated and interacting measures.

For the first time the economic benefit of performing scientific-technical measures is being assigned as an indicator. This provision has great importance. A correct approach to evaluating the efficiency of new technology

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is needed to enhance the role of this indicator in management of production. It is first of all a question of the nature of the benefit to the national economy as an indicator and of the ways in which it will be applied.

It is very important to find methods of correctly measuring the benefit from scientific-technical progress and of reflecting it in the plan, in prices, and in the cost-accounting (khozraschet) indicators of the performance of associations and enterprises. There is an indispensable need to achieve better linkage of the interests of the national economy and cost-accounting interests of work collectives on that basis and to ensure their economic motivation. As an indicator the national economic benefit has the task of exerting an energetic influence not only toward speeding up technical progress, but also on the structure and directions of capital investments and on the proportions in development of the various sectors and industries of the national economy.

At present the methods have not yet been worked out for planning this indicator and for reflecting it in the price and 'n quotas and norms. A discussion is going on in the economics literature as to whether the assigned target of the efficiency of scientific-technical progress should be a cost-accounting indicator or a national economic indicator and as to whether it can be based on recording the reduction of production costs or reduction of full cost to the national economy. National economic efficiency is given the role of an indicator used for computations and analysis (raschetnyy pokazatel') in the methodological guidelines. The field of its application is limited by selection of the version of the new technology and of technical development. As an indicator that is planned and assigned to the target, one included in the system of statistical reporting, the cost-accounting indicator of the benefit is used--the growth of balance-sheet or net profit. Profit in this case becomes the principal indicator of the efficiency of measures related to scientific-technical progress. The benefit achieved as the result of application of technology in the form of the growth of profit is regarded as the particular enterprise's contribution to the country's national income.

Without diminishing the role of cost-accounting indicators, including profit, as indicators of the efficiency of scientific-technical progress which are planned as binding targets, it seems to us that the problem of orienting the activity of each unit in management of production toward the interests of the national economy remains unsolved. The growth of profit at an enterprise taken individually may come into conflict with the interests of the consumer and of the national economy as a whole.

The economic benefit, as an indicator that has been elevated to the rank of planned indicators, should objectively reflect the degree of attainment of the national economic goal of applying new technology. In his Economic Manuscripts 1861-1863 K. Marx wrote: "The purpose of introducing a machine is in its most general form to reduce the cost and probably also the price

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of the commodity, to make it cheaper, that is, to reduce the work time necessary to produce a unit of the commodity...."²

The useful benefit of applying new machines is not, of course, limited to saving on labor. We cannot but take into account the social aspect--creation of new use values, which would be impossible without using the most up-to-date technology and processes, without making work easier and healthier, and so on. In the broad sense the social benefit of applying new technology lies in solving overall problems--increasing the prosperity of the workers, eliminating heavy physical labor, bringing physical labor closer to mental labor and farm labor closer to industrial labor. Only under socialism does it become objectively necessary to evaluate the efficiency of new technology, to determine the limits of its application from the standpoint of the national economy. Society is interested in saving on the entire aggregate labor applied, and not only on that portion of the labor which results in a rise of the rate of profit and the total amount of profit. Thus indicators used to evaluate efficiency under socialism cannot fail to differ from the indicators used by capitalist production and the fullness of their recording of the inputs and the results.

Economists' recognition of social labor as a synthetic and summary indicator of the economy's efficiency presupposes solution of the fundamental problem of economic science--measurement of the expenditures of that labor. In the Standard Method of Determining the Economic Efficiency of Capital Investments and New Technology (1960), which was drafted under the supervision of T. Khachaturov, member of the academy, it was observed that "precise determination of the economic benefit is possible only on the basis of a computation of value. Since that kind of computation is not yet made, indicators of prices and production costs, which give an approximate idea of the actual economic benefit, should be used in determining the economic efficiency."³ The authors of that method should be given due credit for posing the problem of the need to compute value, especially since all subsequent methods have foregone the direct raising of this issue. Apparently we need to return to the problem of computing the true value of products. The present stage in the development of science and technology--the increase in the number of projects, the increasing rates of technical development, and the growth of expenditures to perform scientific-technical measures--necessitates an accurate determination of the national economic estimate of the economic efficiency of new technology.

In practical economic life the price and the production cost are becoming the representatives of value; in the current methodology for official computation and price setting they lose to a considerable degree their relation to their essence--the value of the products. Price elements--the production cost and profit--have become widespread in evaluation of economic efficiency. This is to equate profit with the surplus product and the production cost with current costs. For instance, profit is very often defined as the money expression of the value of the surplus product and it is supposed "that profit consists only of the value of the surplus product

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created by the collective of the given enterprise or other enterprises in the industry and redistributed in full conformity with the law of value."⁴

In our view this assertion is not valid. One can hardly equate the form with the content, the essence of the phenomenon with its external manifestation. First, profit is not simply the money expression of the surplus product, but is a modified and transformed form of the value of the surplus product. Second, under socialism the profit consists not only as a value of the surplus product, but also as a portion of the value of the necessary product, which goes into the sphere of consumption through social consumption funds. Third, the law of value requires equivalent exchange. But since profit also contains a portion of the value created in other sectors or industries or enterprises, there can be no question of full respect for the principle of equivalence. In addition, if profit also includes a portion of the value of the surplus product created by another collective, then how sound is it to regard it as the result of the given collective's performance, its contribution to society's net income?

Profit is an important cost-accounting indicator, one in whose growth the socialist state also has an interest. It seems to us that reducing the purpose of introducing new technology to the growth of profit and profitability is to disrupt the joint subordination of national economic and cost-accounting interests to the detriment of the former, which reflects the laws of socialist production.

Improvement of the economic mechanism is aimed at exploring ways of an optimum route whereby the interests of society and the interests of individual collectives are led onto the same track. It is a complicated problem, but the possibility of solving it follows from the very nature of socialist production relations, in which "the community of interests is elevated to a basic principle..."⁵ The need for and possibility of using a single start-to-finish (skvoznyy) indicator for evaluating the efficiency of new technology at all levels and stages of planning new technology follow from the fact that the interests of the national community are common interests. The unified national economic approach to evaluation of efficiency steps up requirements in selection of alternatives and enhances responsibility of designers and producers of new technology for the realism of the projected operational characteristics. It also makes it possible to calculate the actual benefit and compare it to the benefit anticipated in the design and in the plan, to link evaluation of performance and economic incentives, and to exert a vigorous influence on the consumer's use of the new technology.

The use of new and improved technology has an essential impact on cost-accounting indicators of performance. For that reason the task of planning agencies consists of correctly determining and reflecting this influence in respective sections and indicators of the plan. If the national economic benefit is correctly reflected in the dynamics of cost-accounting indicators, then these indicators reflect the interests of society. The principal way of reconciling economic interests in technical development is to

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evaluate economic efficiency in the stages of design, construction and actual use of new technology from the unified positions of the national economy and to determine the cost-accounting benefit on that basis as a measure of the respective contribution of cost-accounting units participating in the "research--engineering development--production--application" cycle to the overall rise of production efficiency. In evaluation of the economic efficiency of applying new technology it is important to find a form for separate identification of the processes of production and distribution of the surplus product, for computation of value in its net form. We first need to strengthen the functional role of the price in this area. In our view the principal task in improving price setting in this stage consists of "relieving" the price as much as possible of its redistributive and incentive functions. A price is an effective incentive if it correctly reflects socially necessary expenditures. There is no need, then, to overload it with supplemental economic functions, since under socialism there exist economic instruments (financial, credit, etc.) which can successfully perform those tasks.

The July (1979) decree of the CPSU Central Committee and USSR Council of Ministers envisaged a new approach to determining profitability--the ratio of profit to production cost less the value of raw materials, fuel, power, supplies, semifinished products and components used. This standard of measurement brings the amount of profit closer to the surplus product actually created by the collective and improves the objectivity of profit as an indicator for evaluating the performance of the cost-accounting unit. The basic principles of recording costs of reproduction of natural resources and manpower used, of education, of science, and so on, have also been defined. The practical implementation of these measures will bring significant refinements in calculations of economic efficiency as well. But neither the production cost nor the profit, as component elements of social costs, can offer an objective assessment of the benefit when taken separately.

In recent years the opinion has become widespread that the saving against imputed costs reflects most fully the size of the national economic benefit. Here the economic essence of the standard coefficient is equated with the rate of profit, and the product $Y_{\text{N}} \cdot K$ is represented as the value of the surplus product. Thus the imputed costs are equated with the individual and social forms of value. In our opinion this point of view is invalid. Only additional capital investments, and not even their entire amount, possess the ability to save labor. Y_{N} is the standard by which that saving is measured. When the standard coefficient is multiplied by the absolute amount of capital investments, this ability is attributed to all capital investments. Moreover, equating $Y_{\text{N}} \cdot K$ with the surplus product takes us back to setting prices on the principle of the "production price," the impermissibility of whose use under socialism has been proven by many Soviet economists.

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In the context of a planned socialist economy only the rise of productivity of social labor or reduction of full expenditures of labor in production of the unit product can be used to measure the benefit from application of new technology. Full expenditures of labor include expenditures of past labor, embodied labor and live labor, which in turn are divided into expenditures of necessary and surplus labor. In calculations of efficiency it is very important to correctly evaluate expenditures of live labor, since it is a saving on live labor that the application of new technology usually ensures. In view of the problematical demographic situation it is especially important to provide for full recording of and also saving on expenditures of live labor.

The need for full recording of expenditures of live labor has now become acute for the light and food industries. The wage level in these industries is comparatively low, and the wage saving from application of new technology cannot cover the growth of expenditures of past labor. Calculations of the economic efficiency of new technology on the basis of reduction of the production cost, including only a portion of the expenditures of live labor, are holding back the spread of new technology in labor-intensive industries and production operations and are causing overexpenditure and inefficient use of labor resources.

The recording of surplus labor represents the most complicated problem in determining full expenditures of labor. In accordance with the labor theory of value, the surplus product is created only by live labor. Consequently, expenditures of live labor must be made the basis of its computation. Taking as his point of departure Marx' principle and the law of distribution according to work under socialism, to the effect that equal labor creates values of equal magnitude in equal intervals of time, S. Strumilin, member of the academy, concluded that the ratio $m:v$ is constant for different sectors and industries. "The rate of the 'product for society,'" he has written, "in our context, by contrast with the obsolete 'prices of production,' must be the ratio $m:v$, which is independent of the magnitude of c and which is equal for all domains of labor."⁶ The rate of the product for society is variable in time and has a certain value for each stage of development. For instance, in 1959 the ratio $m:v$ was 0.75 (according to calculations of S. Strumilin), in 1962 it was 0.89, in 1972 it was about 1.0 (according to calculations of T. Khachaturov); recently this ratio has been equal to approximately 1.34.⁷

But the question of the rate of the product for society remains a matter of discussion. Most Soviet economists favor the use of rates of the surplus product differentiated by sectors and industries, explaining this by the different technical level of production, the different level of labor productivity, the different level of skills, the different level of complexity of the labor applied, and so on. Technical progress is characterized by differing rates from sector to sector. The conclusion that there are differences in labor productivity is drawn from that. A comparison of labor productivity in different sectors and industries makes no economic sense.

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An increase in the equipment-labor ratio tends to increase the amount of use values created by one and the same labor, but it does not change the amount of newly created value. The proportion in which the newly created value is divided into the "product for oneself" and the "product for society" does not depend on the individual productivity of the particular sector or industry, but on changes of productivity in all sectors and industries necessary for reproduction of manpower. As the value of the means of consumption decreases in these sectors and industries, there may be an increase in the size and rate of the product for society because of the rise of labor productivity. Nor is the reference made by a number of authors to differences in skills and the complexity of labor sufficiently backed up by argument, since it is reduced and equalized labor that is taken in a comparison. Consequently, these differences have no bearing on the rate of the product for society. "If the work of a jeweler," Marx writes, "is more expensive than that of an unskilled laborer, the surplus work time of the jeweler is more expensive in the same proportion than the surplus work time of the unskilled laborer."⁸ Both the amount and the quality of the labor are reduced with more or less accuracy in the wage. Performance of measures to further improve remuneration and the wage rate system makes it possible to use this method successfully to compute full expenditures of labor.

Objective evaluation of the efficiency of new technology based on the methodological principles of Marxist political economy necessitates the recording of full expenditures of labor in every section of the national economy by including in the value of the product expenditures of surplus labor in proportion to expenditures of the paid portion of live labor. Only in such an approach is a social evaluation made of the individual expenditures of live labor by each production section and an objective evaluation of the economic efficiency of application of new technology ensured.

New enterprises are equipped with up-to-date technology, and the old equipment of existing enterprises is gradually undergoing change. There is a gap, then, in the level of labor productivity and a differentiation of individual costs and income of enterprises within one and the same sector or industry. The additional income of an enterprise that introduces new technology represents a variety of differential income comprising the difference between the socially necessary expenditures and individual expenditures of the enterprises which are technically better equipped. The introduction of new technology results first of all in a rise of the individual labor productivity and a reduction of the individual costs. As new technology becomes more widespread, reaching the proportions that determine the social conditions for production of the given product, the rise of the individual labor productivity brings about a reduction of the socially necessary expenditures of labor.

Under certain conditions changes in the price index reflect the dynamic behavior of the economic benefit from technical development of production on the scale of the national economy. Here it is important to take into

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account that a reduction of the socially necessary expenditures of labor occurs only at a certain level of saturation of production with progressive technology. This does not mean that introduction of new technology does not yield a benefit in the national economy up to the moment of reduction of average costs. A saving in any section is important to society, and that saving creates the overall saving on expenditures of social labor. In our view it is best to build the evaluation of economic efficiency before and after application of new technology on the dynamic behavior of the individual cost of production of the given product. The saving on expenditures of past and live labor in any section is individual, but its evaluation must be social in nature, that is, must rely on calculations of the comparative efficiency of the measure performed from the standpoint of the national economy.

This approach to evaluating the efficiency of applying new technology on the basis of the principles and methods of comparative efficiency ensures that identical computations are made in the stages of the design, production and use of technology. Moreover, the comparability of the calculated, planned and actual efficiency affords a reliable assessment of the reduction of the national economic expenditures of social labor and the possibility of comparing this benefit to the additional capital investments. Measuring additional capital investments against the saving on current costs is indispensable because the accumulation fund constitutes a limited magnitude and society is interested in the price at which that economy was achieved, that is, the one-time funds diverted from current consumption.

In the economics literature the opinion is widespread that the national economic benefit is the sum total of cost-accounting benefits of consumers and producers of technology. In our view this concept is incomplete. The national economic benefit is not identical with the sum total of cost-accounting benefits--increments of profit. It is broader than the spheres of influence of new technology and reflects more fully the costs and results. In addition, the faster the new technology spreads and is assimilated by consumers, the more rapidly will the average socially necessary expenditures decrease. This will have the result that consumers are deprived of the additional income, and the sum total of additional profit derived from application of new technology is reduced to a minimum. Thus the appearance is created that the widespread and large-scale use of progressive new technology reduces the benefit obtained by the national economy, which manifestly contradicts the national economic approach.

Acceleration of scientific-technical progress and the growth of the real payoff of technology depend to a considerable degree on the organizational solution of these problems. Here the plan has a leading place as the most important instrument for speeding up technical development. Introduction of the economic benefit as an indicator presupposes the setting up of systematic recordkeeping and analysis of the actual efficiency of new technology, without which management of technical development would be divorced from actual reality and the indicator introduced would not have an impact

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as an incentive. Proper records on actual efficiency are not at present kept anywhere. The present methods of recordkeeping and forms of reporting do not identify nor separately record the output of new technology, which for a number of years "coexists" with the old technology. The calculations of actual efficiency made from case to case offer an incomplete idea of the benefit actually obtained and do not establish the real efficiency of capital investments.

It is an important problem to create conditions for bringing the planned benefit closer to the benefit projected in the design, the actual benefit closer to the planned benefit so as to ensure the real output of the new technology. Success in solving this problem is largely determined by practical implementation of the principles of the comprehensive approach to the planning and motivation of scientific-technical progress. The ideas of the comprehensive approach to management of technical progress have firmly entered into theory and practice. But the "science--production" cycle is bounded by the stage of building the first series of the new prototype. The separation of closely related stages in the production and application of technology violates the comprehensive principle and reduces the effectiveness of the measures performed.

The benefit actually obtained in the national economy depends not only on technical-and-economic parameters set forth in the design, but also on the extent to which they are attained. Evaluation of efficiency in the development and production of highly productive technology does not always correspond to the efficiency of the technology in application by any means. The efficiency of technology and its advantages over the old technology are revealed only in the process of its use. It is therefore important to learn how to manage not only scientific development projects and organization of the production of new technology, but also the level of its use by consumers, which is the actual payoff.

Research has shown that high efficiency, calculations of which are based on ideal and rarely encountered operating conditions and "adjusted" indicators of the base technology and the new technology, is not confirmed in practice. The technical-and-economic indicators projected in the design remain unattained over lengthy periods of operation. For example, after 7-9 years of operation of the Model ATPR-100 air-lance looms, which were the basis for retooling the cotton industry, actual operating rates do not exceed 300-350 rpm, though the design speed is 360 rpm. Moreover, the quality of manufacture, the reliability of operation of individual parts and assemblies, the availability of replacement parts and a number of other considerations do not allow the move to higher speeds. The level that has been attained in labor productivity and in the productivity of the equipment is not yielding the anticipated benefit.

The actual output of new technology is largely determined by the organizational conditions of its operation. Insufficient preparation of enterprises which figure as consumers for assimilation of expensive and highly

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productive technology, "squeezing" it into the old conditions, into the old forms of organization of production and work, the weak reinforcement and spread of progressive operating know-how within individual enterprises, and shortcomings in planning and in work norm setting--all of this holds back the attainment of rated capacity on highly productive equipment for long years.

One of the principal reasons for the low efficiency of application of technology is that related production operations do not develop compatibly with one another. Increasing the actual output of new technology is possible by further improvement of the comprehensive planning of the retooling of enterprises and related production operations. Introducing new and more productive equipment with a fundamentally different method of laying the fill thread in weaving brought about an increase in the need for yarn. It was not possible to meet the greater demand without reequipping the spinning industry, since the internal potential for growth was practically exhausted. The mismatching of the production capacities of spinning, preparatory and weaving operations of cotton enterprises resulted in a shortage of the raw material.

The greatest efficiency in applying ATPR looms can be achieved when they are used jointly with BD-200 pneumatic spinning frames. Unfortunately this exceedingly important condition is not fulfilled everywhere in practice. That necessitates the additional rewinding of the yarn from ring spinning frames onto bobbins, which tends to increase current costs and results in additional capital investments in winding machines and work space.

In the broad sense the term "new technology" includes not only machines and equipment, but also process engineering, the subjects of labor and the organization of production. That is why changes in one of these elements necessitate that all the others be brought into conformity. The size of the national economic benefit depends on the degree to which this correspondence is achieved. The task of managing technical progress consists of better determination of technical and organizational changes in the very stage of design and testing of the new prototype and of preparing the interrelated set of conditions that ensure maximum utilization of the potential capabilities of the technology to be introduced at the time when the technology is being developed and manufactured.

The problems of distribution of new technology also need thorough scientific substantiation. It must be introduced first in those places where conditions have been created for its efficient use. Cases in which highly productive technology is applied in conditions that are economically inefficient may occur only in exceptional cases and must be justified in every aspect.

There must be an effort to combat the squandering of new technology in the first years when the volume of production is limited and when there is no opportunity to supply it to all enterprises. The principle of distributing

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"something to everyone, at least one little machine" is holding back the retooling of enterprises for long years, is hampering the attainment of rated capacity and the maximum utilization of the potential capabilities of progressive technology. As a result the national economy is suffering losses instead of receiving the "promised" benefit. The frequent additions of new technology on a small scale are painful to production and tend to detract from the principal technical-and-economic indicators and to reduce the economic motivation of enterprises to apply new technology. The scale on which deliveries of technology are made to consumers must be optimum from the standpoint of the organization of production and of work. For instance, in industries where one worker attends several machines, additions of new technology on any one occasion must be equal to or multiples of the optimum service zone.

The actual national economic benefit depends on adhering to proper sequence in the replacement of technology. Cases are still frequent in which comparatively new machines are replaced, while more worn-out machines and more obsolete machines still exist at related enterprises and should have priority for replacement. In the retooling of old enterprises the problem frequently arises that the construction, layout and size of work areas does not meet the requirements of efficient use of the technology and rational organization of the work of the principal production workers and auxiliary workers. Such situations need to be taken into account in planning the retooling and reconstruction of enterprises.

The economic efficiency of new technology is a function that varies in time depending on the level of technical and organizational realization of the potential capabilities of the technology being introduced. It is obvious that there is a certain pattern of optimum assimilation for any type of technology. In each particular actual case the dynamic behavior of the process of attainment of rated capacity may not coincide with the overall pattern because of the impact of some particular specific conditions. But discovering the overall and objective pattern of attaining rated capacity for a specific model of equipment will help in transforming it into a process that can be managed and can be regulated by plan. Knowing the general pattern of the process of attaining rated capacity will make it possible to calculate and establish standard coefficients for attainment of rated capacity of technology over the entire period of operation. As a function of the type of technology and conditions of application one can establish coefficients for technical and organizational assimilation or a single synthetic coefficient, and they should be made the basis of plans for output of products and other sections of the plan.

Attainment of the design characteristics of new technology in conformity with plan on the basis of standard coefficients for assimilation will bring the actual economic benefit as close as possible to the benefit anticipated in the design and will make it possible to monitor the use of technology and to discover the reasons as they occur for deviation of actual attainment from the planned attainment of rated capacity and to correct them

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responsively. This will serve as an effective incentive for consumers to make maximum use of the capabilities of technology from the moment it is put into operation.

FOOTNOTES

1. PRAVDA, 24 June 1980.
2. K. Marx and F. Engels, "Sochineniya" [Works], Vol 47, p 351.
3. "Tipovaya metodika opredeleniya ekonomicheskoy effektivnosti kapital'nykh vlozheniy i novoy tekhniki v narodnom khozyaystve SSSR" [Standard Method of Determining the Economic Efficiency of Capital Investments and of New Technology in the USSR National Economy], Gosplanizdat, 1960, p 6.
4. Z. V. Atlas and V. Ya. Ionov, "Effektivnost' proizvodstva i rentabel'nost' predpriyatiya" [The Enterprise's Production Efficiency and Profitability], Izdatel'stvo Mysl', 1977, p 86.
5. K. Marx and F. Engels, "Sochineniya," Vol 2, p 538.
6. S. G. Strumilin, "Izbrannyye proizvedeniya" [Selected Works], Izdatel'stvo Akademii nauk SSSR, 1965, Vol 1, p 104.
7. Different authors give different figures in calculations of the rate of the surplus product because there is no single methodological approach to measuring the necessary and surplus products. For example, G. Sorokin gives the following dynamic series: 1950--101 percent, 1955--106, 1960--107, 1965--115, 1968--122 and 1970--134.5 percent. Calculations based on published statistical materials according to a method close to S. Strumilin's method--the rate of the "unpaid portion of live labor" as a ratio of the national income used for consumption and accumulation after deduction of the wage fund of workers and employees in the production sphere to the latter indicator--have confirmed that in the 1961-1965 period this rate was 1.16, in the 1966-1970 period it was 1.25, and in the 1971-1975 period it was 1.34.
8. K. Marx and F. Engels, "Sochineniya," Vol 26, Part II, p 424.

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INTRODUCTION OF NEW TECHNOLOGY

BETTER CRITERIA SOUGHT FOR EVALUATING TECHNICAL RESEARCH

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[Article by S. Golosovskiy: "Efficiency of R&D Projects"]

[Text] Economic evaluation of the results of R&D is an important instrument for speeding up their application to production. The decisive indicator here will now be the economic benefit the national economy derives from introduction of scientific-technical advances per ruble of costs by research institutes and design bureaus. At one time it was proposed that the ratio of the economic potential to the total preproduction costs be taken as the criterion of the economic efficiency of R&D projects.¹ This was an important step in the methodology of determining the efficiency of scientific research. It became possible to discover a scale for evaluating the payment of economic results, though this criterion's field of application was limited to the specific year of introduction. In our opinion the criterion of economic efficiency of R&D and of the field of its application are in need of revision.

The conditions for this criterion's application are related to the peculiarities of outlays for R&D which scientific-technical organizations incur in order to solve specific economic, social and scientific problems and which are classified as preproduction costs. Their purpose is to create the scientific-technical product. The coefficient E_{π} can serve as the criterion of the efficiency of preproduction costs. It represents the ratio of the economic benefit (difference in imputed costs) obtained in production thanks to utilization of the results of scientific-technical developments (taking into account the share of scientific research institutes) to preproduction costs incurred to obtain those results. The source of the preproduction expenditures is the accumulation fund. The coefficient E_{π} , then, reflects the degree of benefit society derives from diverting funds from the national income to conduct R&D projects and to apply their results.

Up to now the sphere of application of the coefficient E_{π} and of its standard value has not been altogether clear. For instance, the opinion has been expressed that E_{π} cannot be used for selection of variants of scientific-technical designs, since in certain cases it leads to selection of

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the worst alternative of the scientific-technical development and the worst variant of production.² The evidence given for this proposition is a comparison of the difference in imputed costs for the two variants and the development costs. In our view this argument overlooks the specific nature of calculations of the efficiency of scientific research, specifically the fact that all costs of developing and applying the new measure must be taken into account, and the share of the particular organization in attaining the economic benefit must also be taken under consideration.

The coefficient E_{π} differs in its content from the standard coefficient of capital investments E_H , which is to be expected. The economic nature of outlays for research and development is not the same as that of outlays for capital investments. Though they have a common source--the accumulation fund, their economic role in the process of expanded reproduction is different. Capital investments are directly realized in physical inventories--fixed capital and working capital participating in the process of producing the product and performing physical services. Outlays for research and development are aimed at obtaining new knowledge, which is their immediate goal, and that knowledge will then be used to create new technology and will be realized in production in the form of fixed and working capital. In addition, the coefficient E_{π} also reflects the economic risk involved in incurring preproduction costs. "... Standard coefficients," T. Khachaturov, member of the academy, has noted, "must differ as a function of which indicators are used in making the computations."³ For example, computations of the standard coefficient of the efficiency of capital investments (E_H) are made with the indicators of profitability or the saving on the production cost. The coefficient E_{π} is calculated on the basis of the relationship between indicators of the economic benefit pertaining to R&D and the preproduction cost. This makes it inevitable that E_{π} will be greater in magnitude than E_H .

It would seem that E_{π} must differ as a function of the purposes of the evaluation: it may be unified for science and differentiated by its fields and the branches of physical production served by the R&D organizations. The unified coefficient E_{π} for science will make it possible to compare the influence of its results on the national income with the influence of other principal factors so as to work out measures to increase the benefit from scientific-technical advances. In so doing we should take into account that not all outlays for science are aimed directly at economic goals, that is, at the attainment of scientific results that afford the possibility of obtaining an economic benefit through their use. Of course, in these cases the problem of computing the coefficient of efficiency does not even exist.

There is the greatest interest in determining the coefficient E_{π} for individual industries and for agriculture, transportation and construction, that is, in the sector or industry where scientific-technical developments are actually used. Here the opportunities are also greater for obtaining the necessary initial indicators. The average values obtained may be used as reference data for comparing the E_{π} figures for research institutes and

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design bureaus of the respective industries and sectors. In addition we also need lower limit values of efficiency coefficients, which show the limits below which outlays for science are economically inefficient.

In the first approximation it can be established that E_{Π} is equal to the standard coefficient of efficiency of capital investments E_H , which represents the standard lower limit of one-time investments, multiplied by the risk coefficient (R), that is, $E_{\Pi} = E_H \cdot R$. The indicator of the risk involved in preproduction outlays may be calculated on the basis of the fact that all outlays do not yield an economic benefit, but only those which are realized in projects applied in physical production and for which the benefit can be determined. Thus the indicator R may be expressed as the ratio of all outlays to obtain the scientific result (ΣS) to the value of the result applied (S_{BH}), that is, $R = \Sigma S / S_{BH}$. If we assume that 30-40 percent of the results of all R&D projects conducted in a given year are applied to production on the average, then $\Sigma S = 1$, $S_{BH} = 0.3-0.4$. In this case by multiplying the value $E_H = 0.15$ by the values of R , which are 3.33-2.5, we find that E_{Π} will be in the limits from 0.5 to 0.38. On the average we can take E_{Π} as equal to 0.45.

This coefficient E_{Π} can be used to work out ways of increasing the results of a scientific-technical organization's effort. For instance, we analyzed the dependence of E_{Π} on the size of the scientific groundwork already done and outlays to introduce projects completed in one of the scientific research institutes. We determined the following for the specialized scientific lines of the institute's effort, including theoretical and practical problems of creating specific types of new technology: 1) the coefficient of the proportion of theoretical and exploratory work (K_{Teop})--the ratio of outlays for these projects to the sum total of outlays for each line over the 5-year period; 2) the application coefficient (K_{BH})--the ratio of outlays for projects applied over the 5-year period to all outlays.

The values of K_{Teop} may range within the limits from 0 (no theoretical and exploratory work) to 100 (purely theoretical effort). The analysis we conducted showed that E_{Π} increases directly with the size of outlays for scientific spadework up to the maximum value K_{Teop} (up to 30 percent in the institute where we conducted our survey), and then E_{Π} decreases. The value of E_{Π} also increased directly with an increase of K_{BH} up to 40-50 percent. Moreover, the lowest E_{Π} is at a low K_{BH} (10-15 percent) and an extremely high K_{BH} (70 percent). In the latter case the scientific projects assume the character of technical assistance. Here there is hardly any scientific spadework at all, and later the economic benefit may decrease for these narrow lines of scientific effort.

The two coefficients we have been considering (K_{Teop} and K_{BH}) require in our view serious analysis and study, since in a number of scientific organizations there has been a tendency toward a decrease of scientific spadework and an excessive increase of the number of small topics whose benefit is small, but which make for speedy application. As a result the efficiency of scientific research tends to decrease.

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The value of E_{Π} depends on the total economic benefit derived for the given preproduction costs. The economic benefit is substantially influenced by the degree of newness of the technology to be applied, and that depends upon the standard or benchmark chosen (the basis of comparison). At the present time it is recommended that the indicators of the best technology designed or existing in the USSR or foreign technology which can be purchased or developed in the USSR by acquiring a license be taken as the standard (basis of comparison) in the stage of working up plans of R&D projects.⁴ But this does not take into account the time factor, which has essential importance. For instance, it takes about 3-5 years to carry out planned topics related to development of a specific piece of new technology, as much as 1.5 years to go from the scientific-technical documentation to production, and the time from the taking of the decision to set up production and the manufacture of the series-produced product is approximately 1-2 years. Consequently, 5-6 years often pass from the placement of the scientific research topics in the institute's plan up to the taking of the decision on the need to manufacture the given piece of equipment, and 7-8 years pass before the series-produced product is manufactured. In that time more progressive prototypes of new technology will be developed and applied. Even technology created on the basis of a comparison with the indicators of that technology which is best at the moment of development will be obsolescent by the time it is applied.

New technology must exceed the indicators of the best technology at the moment when series production begins. This can be achieved if in the stage of compiling the institute's topic plan, that is, when the preliminary economic benefit is being calculated for the scientific research project, the initial technical-and-economic indicators (productivity, durability, consumption of energy and materials, etc.) are determined according to the results of forecasting studies of future trends of scientific-technical progress in the sector or industry, which must be regularly conducted in the head scientific research organizations of the respective industries and sectors.

The indicator of the share of the given organization in creating the economic benefit must be taken into account in calculating E_{Π} . This share is determined in accordance with the Regulation on Awarding Bonuses to Personnel of Enterprises and Organizations for Creation and Application of New Technology (dated 26 December 1964), which sets forth fixed values of the share of R&D organizations and also of enterprises in the economic benefit from application of new technology. The share of scientific research work (NIR) and of project planning and design work (PKR) is established in the range of 30-50 percent of the total amount of the economic benefit. In actuality the share of NIR and PKR may be far lower than or greater than the figures established. It is therefore indispensable to perfect the present method of determining the share. It is best to first divide the benefit from application of new technology between production organizations and scientific organizations, and then between scientific research institutes and design bureaus or subdivisions of the same organization.

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To conduct an analysis of the evaluation and stimulation of the activity of production organizations and scientific organizations the benefit might be distributed between them so as to take into account the different functions of science and production. The principal function of applied research and development is to develop new technical-and-economic parameters of technology (including development of fundamentally new types of technology as well), while the principal function of production is to materialize the scientific advances, to put the new technology into production and to disseminate it. Accordingly, the economic benefit from improvement of the technology's parameters can be credited to the share of science, and the benefit from putting the new technology into production, from producing it and from disseminating it can be credited to production's share.

Distribution of the economic benefit from application of new technology among the participants in development and application should in our opinion take into account the amount and quality of their effort. The amount of effort depends on the degree of complexity of the scientific-technical problem to be solved and is determined on the basis of planning data or actual data. The quality of the effort is reflected in the creative contribution, which is best assessed on a three-point scale in accordance with such characteristics as degree of newness, theoretical soundness and extent of experimental verification of the scientific-technical result.

A number of conditions are taken into account to ascertain the degree of newness: first, partial refinement of products, manufacturing processes and materials (one point is given to this); second, essential improvement of their characteristics (two points); and third, development of new directions in the creation of products, manufacturing processes or materials (three points).

The level of creative soundness is determined on the basis of whether a constructive solution was found to the engineering problem by means of simple generalizations (one point), or whether certain general laws were established which could be used outside the given project (two points), or a new approach was discovered to solving the engineering problem in which this project is a special case (three points). The degree of experimental verification of the results obtained is also evaluated on a scale from one to three.

These characteristics of the scientific-technical significance of R&D projects have different weighting coefficients (mathematical weights): the degree of newness is assigned the coefficient 0.5, the level of theoretical soundness 0.333, and the extent of experimental verification of the results obtained--0.167. The size of the creative contribution as a whole is computed from this formula:

$$K_{TB} = B_1 I_1, \quad (1)$$

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in which K_{TB} --coefficient of the creative contribution; B_i --evaluation of the i -th characteristic (in points); I_i --mathematical weight of the i -th characteristic (in portions of unity).

The share of scientific research institutes and design bureaus can be calculated from this formula (in percentage):

$$A_{y,i} = \frac{K_{TB_i} \cdot B_i \cdot 100\%}{\sum_{i=1}^n K_{TB_i} \cdot B_i}, \quad (2)$$

in which $A_{y,i}$ --share in the economic benefit for the i -th work item; K_{TB} --coefficient of the creative contribution for the i -th work item; B_i --amount of wages for the i -th work item; $\sum_{i=1}^n K_{TB_i} \cdot B_i$ --total adjusted outlays for the related group of work items; n --number of work items involved.

Formula (2) can be used to ascertain the share if information is available on the costs and creative contribution of all participants in the development project. But when the scientific topic plan is being drawn up or when a stage of the project has been completed, it often happens that such information is not available. In these cases the share of the organization can be determined on the basis of the labor intensiveness of the stages of research and development typical of the given sector or industry (subindustry or subsector) from this formula (in percentage):

$$A_{y,i} = \frac{T_i R_{3H_i} \cdot 100}{\sum_{i=1}^n T_i \cdot R_{3H_i}}, \quad (3)$$

in which $A_{y,i}$ --share of the i -th organization in the economic benefit; T_i --approximate labor intensiveness of the i -th stage of our R&D (taken from tables compiled by the head institutes of the sectors or industries);⁵ R_{3H_i} --coefficient of the significance of i -th stage of R&D (taken from a special table); n --number of stages in the R&D project.

The size of the economic benefit credited to scientific and design organizations decreases with time, since as the new technology becomes more widespread the costs of the product manufactured with that technology approach the socially necessary expenditures. Moreover, in the process of producing the new technology the manufacturers make refinements, so that the size of the economic benefit credited to their share increases. For cases when it is not possible to ascertain the share of the scientific organization in the benefit by years of the period covered by the calculation, the size of the share should be annually reduced so that at the end of the period covered by the calculation it does not exceed 30 percent of the share originally established.

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It is best to reckon on the economic benefit credited to the scientific organization over the entire period covered by the computation, whose length should be determined from the time when the development project began to application of the results of R&D. In aggregate computations of economic efficiency it is indispensable to know the average length of the period covered by the computation, which may be determined by using figures on outlays for science, which indicate performance of the research process, and figures on inventions applied for the first time. We should note that for physical production one of the most important indicators is the number of inventions applied.

The majority of inventions are created in staffs of scientists, designers and process engineers with funds from the state budget. As an analysis shows, about 80 percent of all applicants for registration of inventions work in scientific research and project planning and design organizations. To calculate the average length of the period for realizing scientific research we used the figures for the correlation coefficients and coefficients of variation between years when outlays were made for science from the state budget and other sources and when the inventions were applied.⁶

Year	Expenditures for Science		Inventions First Ap- plied (%)	Year	Expenditures for Science		Inventions First Ap- plied (%)
	In Billions of Rubles	%			In Billions of Rubles	%	
1956	1.73	100	100	1967	8.2	474	443
1957	2.08*	120	117	1968	9.0	520	562
1958	2.40	139	116	1969	10.0	578	583
1959	2.80	162	134	1970	11.7	676	605
1960	3.90	225	196	1971	13.0	751	748
1961	4.10*	231	245	1972	14.4	832	837
1962	4.30*	249	343	1973	15.7	907	916
1963	5.10	295	386	1974	16.5	954	746
1964	6.00	347	465	1975	17.4	1,006	1,109
1965	6.90	399	517	1976	17.7	1,023	1,167
1966	7.50	433	382	1977	18.3	1,058	1,246

* Interpolation.

It is evident from the table that the growth rates of inventions applied for the first time exceed in most cases the rates of expenditures for science. A certain period of time is necessary to create and apply inventions, and therefore calculations of the coefficients were made with a successive change of the lag between the years when expenditures for science were made and when the inventions were applied from 0 to 7 years over a lengthy period.

The correlation coefficients R and the coefficients of variation V were calculated with the formulas of the linear equation ($y = ax + b$) and the

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exponential function ($y = a + b^t$) on a computer. The figures of the coefficients are given in the table below.

Lags, in years	R		V'	
	$y = ax + a$	$y = a + e^t$	$y = ax + a$	$y = a + e^t$
0	0,866	0,845	0,149	0,162
1	0,879	0,850	0,141	0,157
2	0,897	0,865	0,131	0,149
3	0,908	0,877	0,123	0,143
4	0,914	0,884	0,119	0,139
5	0,929	0,895	0,108	0,131
6	0,923	0,889	0,112	0,136
7	0,926	0,866	0,111	0,136

As we see, the largest correlation coefficient and smallest coefficient of variation were obtained when the lag between the incurring of expenditures for science and application of inventions was equal to 5 years. We can also adopt this period as the average period covered by the computation in calculating the efficiency of research and development projects.

An important question is the accuracy of determination of the economic benefit. Cases are not infrequent when the initial data needed for calculation of the benefit do not possess sufficient accuracy. For that reason the results obtained in the calculations are also imprecise and deviate from the true value of the size of the benefit; that is, these results lie in certain numerical intervals. If we do not know the range of possible changes of the initial data, the size of the scattering of the average value of the benefit can be established from the upper and lower limits of the possible change of its calculated value assigned for the particular year of application of the new technology with the following formulas:

$$\mathcal{O}_B = \mathcal{O}_{CP} \cdot \Pi_B; \mathcal{O}_H = \mathcal{O}_{CP} \cdot \Pi_H,$$

in which \mathcal{O}_B and \mathcal{O}_H --upper and lower limits of the preliminary (anticipated) economic benefit, respectively; \mathcal{O}_{CP} --average size of the economic benefit anticipated in the assumed year of application of the results of R&D; Π_B and Π_H --assigned coefficient of the upper and lower limits of the economic benefit, respectively.

The research we conducted showed that in spite of the theoretical equality of the size of the deviation of the results of the calculations upward and downward from the average value, in practice the upward deviation of the benefit exceeds the downward deviation of the benefit. Analogously, then, to the indication of tolerances in engineering when the dimensions of parts are being measured, the size of the benefit should be defined as an average (\mathcal{O}_{CP}), and the size of the upward and downward deviation should be indicated. When the average values of the benefit are equal for the variants

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of R&D in which one and the same problem is being solved, preference should be given to that variant which has the lower value of $\Delta\mathfrak{B}_H$.

We should note the following in connection with calculation of the upper and lower limits of the coefficients. The Method of Determining the Economic Efficiency of New Technology⁷ furnishes an approach to taking into account the factor of indeterminacy (possible errors) in which the size of the errors and the character of their variation are established for spheres of application of the given type of technology. Deviations of the anticipated values of the benefits from their average values are related to the specific year from the first to the last year of the new technology's use in the i -th sphere. Equal deviations of the indicators of the upper and lower limits of the benefit from its average value are moreover taken regardless of the sphere of application; that is, deviations of the anticipated values of these benefits from their average values in the t -th year will be (according to the recommendation in the method) within the limits from $1.97^t \cdot \mathfrak{B}_i^t$ to $1.03^t \cdot \mathfrak{B}_i^t$. This recommendation is progressive, but the size of the deviations was established by expert evaluation and needs revision. The experience of a number of scientific research institutes shows that the actual economic benefit in the final sphere of application of new technology is one-half or one-third the size originally established. In order to establish a fixed size of the error in calculating the benefit in the stage of development and application of new technology we must, then, conduct specific studies concerning various types of technology.

The decree of the CPSU Central Committee and USSR Council of Ministers entitled "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and the Quality of Work" pays a great deal of attention to speeding up the realization of scientific-technical discoveries and developments aimed at raising the growth rates of labor productivity and improvement of the quality of performance. This would be greatly furthered by working out new procedural principles for determining the efficiency of R&D, so that the methods make it possible to evaluate more accurately the results of applying scientific-technical advances.

FOOTNOTES

1. "Osnovnyye metodicheskiye polozheniya po opredeleniyu ekonomicheskoy effektivnosti nauchno-issledovatel'skikh rabot" [Basic Procedural Principles for Determining the Economic Efficiency of Scientific Research Projects], Izdatel'stvo Ekonomika, 1964, p 14.
2. See, for example, E. P. Bayandin, "Kriteriy effektivnosti nauchno-tekhnicheskikh razrabotok" [Criterion of the Efficiency of Scientific-Technical Development Projects], Izdatel'stvo Ekonomika, 1973, pp 57-60.

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3. T. S. Khachaturov, "Intensifikatsiya i effektivnost' v usloviyakh razvityego sotsializma" [Intensification and Efficiency in the Context of Advanced Socialism], Izdatel'stvo Nauka, 1978, p 240.
4. "Metodika (Osnovnyye polozheniya) opredeleniya ekonomicheskoy effektivnosti ispol'zovaniya v narodnom khozyaystve novoy tekhniki, izobreteniy i ratsionalizatorskikh predlozheniy" [Method (Basic Principles) of Determining the Economic Efficiency of Utilization of New Technology, Inventions and Efficiency Proposals in the National Economy], Izdatel'stvo Ekonomika, 1977, p 6.
5. Determination of standard indicators of labor intensiveness or of costs by stages of R&D for sectors and industries (subsectors and subindustries) is a realistic possibility, as indicated by the experience of the pulp and paper industry and wood chemical industry (A. N. Kalimanov and V. N. Leksin, "Otsenka effektivnosti nauchno-tekhnicheskoy deyatel'nosti v otrasli" [Evaluation of the Efficiency of Scientific-Technical Activity in an Industry], Izdatel'stvo Lesnaya promyshlennost', 1979, p 19).
6. Expenditures for science were taken from the data of statistical yearbooks of the Central Statistical Administration: "Narodnoye khozyaystvo SSSR v 1959 g." [USSR National Economy in 1959], statistical yearbook, Izdatel'stvo Statistika, 1960, p 805; "Narodnoye khozyaystvo SSSR v 1922-1972 gg." [USSR National Economy in the 1922-1972 Period], p 483; "Narodnoye khozyaystvo SSSR v 1962 g.," p 637; "Narodnoye khozyaystvo SSSR v 1968 g.," p 776; "Narodnoye khozyaystvo SSSR v 1970 g.," p 732; "Narodnoye khozyaystvo SSSR v 1975 g.," p 744; "Narodnoye khozyaystvo SSSR v 1977 g.," p 561. Inventions applied for the first time were determined from the data of the USSR State Committee for Inventions and Discoveries.
7. "Metodika opredeleniya ekonomicheskoy effektivnosti novoy tekhniki" [Method for Determining the Economic Efficiency of New Technology], Moscow, IE AN SSSR, 1973, p 21.

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