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THE ECONOMIC EVALUATION OF NATURAL RESOURCES*

At the June (1980) Plenum of the Central Committee of the Communist Party of the Soviet Union, L. I. Brezhnev stated: "A maximum effort – and this point must be stressed – must be made to fulfill and overfulfill the plan in the concluding year of the Tenth Five-Year Plan, to commission priority construction projects on schedule, and to ensure the stable operation of the national economy in 1981 – the first year of the Eleventh Five-Year Plan."

A maximum effort is also required in finding and utilizing internal production reserves and in further curbing material intensiveness by reducing losses and by using natural resources more rationally.

The rational use of natural resources necessitates the economic evaluation of natural resources. There are various types of evaluation: technical, technological, geological, and economic. Economic evaluation is the most general type.

The economic evaluation of natural resources has been widely discussed in the economic literature. (1) The urgency of the economic evaluation of natural resources and of making practi-

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cal use of this evaluation increases significantly at a time when we are implementing the decree of the Central Committee of the CPSU and the USSR Council of Ministers "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing the Effectiveness of Production and the Quality of Work." According to the decree, USSR ministries and agencies and councils of ministers of union republics develop programs for the protection of nature and the environment and ratify them as a part of the five-year plans so that advances in science and technology are fully taken into account in plans for economic and social development.

If the economic mechanism is to be more instrumental in increasing the effectiveness of production and improving the quality of work, the cost-accounting basis of protecting and rationally using natural resources must be improved, and this is also impossible without their economic evaluation. Finally, in order to increase the effectiveness of social production, it is essential to incorporate the evaluation of natural resources in the system of economic calculations, since production is the process of interaction between nature and society, and natural resources are the natural basis for the production and formation of material goods that are part of the national wealth.

At the same time, the existence of a number of debatable points in the guidelines on the economic evaluation of natural resources (expenditure and rent concepts, determination of the poorest natural resource and principles used in its evaluation, specific procedures for evaluating mineral resources, the time factor, etc.) hinders their use in planning and in the implementation of planning decisions.

All methods and methodological principles regarding the economic evaluation of natural resources can be reduced to two basic concepts: (1) the evaluation of natural resources must be based on socially necessary labor inputs in their development and in preparations for their exploitation; and (2) the evaluation of natural resources must be based on capitalized differential rent.

Academician S. Strumilin (whose works give the most con-

sistent and complete development of the expenditure concept) proposed that the evaluation of specific plots of land be based on the yield on that plot and on current expenditures on production (2), in the belief that the evaluation of the best, easiest to develop land would be lower than the evaluation of the poorest land, the development of which requires considerable expenditures, i.e., he essentially favors the second concept.

There is better theoretical and methodological substantiation for the proposal to base the evaluation of natural resources on the capitalization of differential rent (Academician T. Khachaturov, Academician N. Fedorenko, K. Gofman, M. Loiter, and others). This concept is based on the idea that natural factors influence the level of labor productivity. Accordingly, surplus profit can be obtained from using natural resources that are characterized by more favorable natural conditions and factors.

As we know, economic or natural factors that may be accessible to only a certain circle of enterprises and farms in a given period of time are the basis of surplus profit. In most instances the more favorable economic factors of production are the result of preceding labor. They are reproducible and consequently are accessible to every socialist enterprise, but for a given enterprise (or group of enterprises) they are temporary. The more favorable natural factors that influence the level of labor productivity are not reproducible and therefore are of a constant, stable nature.

The differences in the economic nature of social and natural factors influencing the level of labor productivity also predetermine the difference in forms of surplus profit. Surplus profit based on more favorable socially reproducible factors of production is of a temporary nature and may be realized at all enterprises in a given branch and in all branches of the national economy. Surplus profit is realized as a result of the economical use of more favorable natural factors of production only in branches of the extractive industry, forestry, and agriculture. According to K. Marx's theory of labor value, natural resources possess value if labor was involved in their creation. Marx noted that capitalized land rent, which forms the value of land, is

an irrational category, "since land is not the product of labor and consequently is devoid of value." (3) However, he admitted that the "imaginary form of price, e.g., the price of untilled land, which has no value since it does not embody human labor, may conceal within itself a true value relationship or a relationship derived from it." (4) And further: "The ownership of a waterfall in itself has no relationship whatsoever to the creation of surplus value (profit) and therefore also to the price of a good that is produced by means of the waterfall. This surplus profit would exist even if there were no ownership of land whatsovever. . . ." (5) Under socialist production conditions it takes the form of differential rent. This stems from the independence of cost-accounting socialist enterprises given the socialist state's monopolistic ownership of land and its mineral resources.

The right of socialist enterprises to the enjoyment of land and minerals on a full cost-accounting basis must be viewed as a specific socialist form of monopoly of land and minerals as economic entities. The existence of the two types of monopoly on land and minerals in the face of the relative scarcity of natural resources leads to the transformation of surplus income into differential rent.

In comparisons of a plot of land (deposit, etc.) with the poorest plots, consideration is given only to the influence exerted on labor productivity by natural factors, and total comparability of socioeconomic and production factors is assumed. Most natural resources that are drawn into national economic circulation are means of production. Thus mineral resources, which presently account for over 70% of the output of the extractive branches of industry, specifically coal and iron, were characterized by V. I. Lenin as true " 'means of production' for means of production." (6) In his examination of the influence of the productivity of machines on labor saving, Marx noted that this saving is equal to the level of productivity of machines: "the productivity of a machine is measured by the degree to which it replaces human labor power." (7)

Proceeding from the foregoing, we consider as methodolog-

ically legitimate Academician T. Khachaturov's proposed definition of the economic evaluation of natural resources based on the capitalization of differential rent: "Differential rent is the effect derived from using resources of higher quality; this effect is expressed in higher labor productivity. There is some similarity here to more sophisticated means of labor: the effect derived from their application is also manifested in higher labor productivity, and this justifies their application, which requires capital investments." (8)

When we know the effect that can be obtained as a result of utilizing more favorable natural factors (differential rent – R) and arbitarily assume it to be equal to the comparative effect resulting from the use of more productive means of production, which is regulated by the coefficient of relative effectiveness of capital investments ($E_н$), we can roughly determine the economic evaluation of natural resources (S) on the basis of the formula (9)

$$S = \frac{R}{E_н}. \qquad (1)$$

The calculation of differential rent is associated with the determination of a natural resource that is characterized by relatively poorer natural conditions and the magnitude of maximum allowable expenditures that form the socially justified limit to expenditures, given that the economy's needs for the particular type of natural resource are satisfied. The magnitude of maximum allowable expenditures is influenced by technical progress, which determines the trend toward their decline, and by the national economic circulation of an ever broader range of natural resources, which generates an opposite trend as a result of the increasing differentiation of expenditures. The calculation of the result of these two opposing trends is one of the basic tasks of planning and forecasting; when performed, it makes it possible to establish the maximum allowable expenditures for the given period.

Maximum allowable expenditures can be established not only for the country as a whole but also for individual regions, zones, and deposits depending on the scale of production and the loca-

tion of enterprises in various branches of natural resource utilization, and on differences in natural conditions and the differentiation of expenditures and transportation costs occasioned by them. Moreover, the magnitude of maximum allowable expenditures on a given natural resource can be established depending on the character of the planning and economic tasks they are used to realize (for example, the determination of the sequence of exploitation of deposits and the scheduled shutdown of spent deposits).

In the process of determining the level of maximum allowable expenditures, it is essential to take into account world prices on natural resources that occupy a high share in our country's export-import operations. The planned limits to maximum allowable expenditures are based on data in the state plan. Calculations of differential rent should be related to the period for which the given level of maximum allowable expenditures is established. At the same time, it should be considered that maximum allowable expenditures have a limited sphere of application: they are now used only to determine the economic evaluation of natural resources.

The specific features of the economic evaluation of mineral resources (compared with other types of natural resources) stem from the nonreproducibility and relative scarcity of minerals in every deposit, from the determinacy of their qualitative characteristics, and from the geographical and geological conditions of occurrence. The realization of differential rent in agriculture cannot be transferred from one year to the next, while at the same time, the magnitude of mine rent to be realized is mediated by the quantity of mineral reserves in a given deposit. In the process of using plots of land, it is possible to select the agricultural crop that is most productive under the given conditions. There is no such choice in the mining industry. Only the completeness of extraction of a given mineral and of various components may vary.

Research on changes in outlays on extraction (taking the cost of geological prospecting into account), on primary processing, and on the transportation of various minerals from a number

of deposits to the consumer during the time that the deposits are being worked shows that annual mine rent and mine rent per ton change during the entire period a deposit is worked. They are modified under the influence of changes in expenditures on the extraction and enrichment of minerals in a given deposit (which on the one hand is influenced by scientific and technical progress and on the other hand by changes in quality, the conditions of occurrence of minerals, etc.), transportation costs, and the magnitude of maximum allowable expenditures.

In a number of cases the duration of the action of favorable natural factors and the realization of differential rent are shorter than the time deposits are worked. As a consequence, in the final period that a deposit is worked (10), extraction costs may rise to the level of maximum allowable expenditures for a given region, basin, or branch as a whole. Stages of intensive working of deposits are usually associated with the action of more favorable natural factors. Thus differential mine rent forms in almost all deposits, but its duration differs: it may be equal to the entire period of working of deposits or may be confined to its individual stages.

The foregoing determines the need to make special calculations in order to determine the average annual magnitude of mine rent ($Д_{ср}$), which is computed: for newly discovered deposits earmarked for exploitation, by dividing the total mine rent that can be obtained from a deposit during the entire period of its exploitation irrespective of the duration of action of favorable natural factors; for old deposits, by dividing total mine rent for years of projected exploitation by the remaining period of exploitation of a deposit.

The calculation is based on the following factors:

$$R = \frac{R_т}{T} \tag{2}$$

$$R_т = \sum_{t=1}^{т} R_i, \tag{3}$$

where $R_т$ is total mine rent that can be obtained from a deposit for the entire remaining period of exploitation (in rubles); R_i is mine rent in the i-th year of exploitation of a deposit (in ru-

bles); T is the duration of the exploitation of a deposit; t is the estimated period of evaluation of a deposit (excavation unit) calculated starting with the year of evaluation ($t_1 = 1$) to the year in which the deposit is shut down ($t_T = T$).

The legitimacy of considering the time factor in the determination of R_T is debatable. In our opinion it leads to the artificial understatement of annual average mine rent (R) compared with average annual rent used to evaluate other types of natural resources (e.g., land) and consequently the magnitude of the evaluation. The exploitation of deposits is calculated in tens of years, whereas discounting is primarily used in comparative calculations of short-term investment programs for stimulating the reduction of construction time. The use of the discounting method in computing total mine rent in order to determine its average annual magnitude used for the economic evaluation of deposits leads to the unsubstantiated reduction of balance reserves in the absolute majority of objects (11) and to lowering the cost-accounting stimuli of mining enterprises vis-à-vis the rational use of mineral resources.

While examining the specific features of the economic evaluation of mineral resources, we note that mineral reserves in every deposit are nonreproducible, and the natural and material basis of mine rent ceases to exist when they are exhausted, whereas the possibility of using land in agriculture is not limited in time (with the appropriate agricultural measures, the fertility of the soil may even be raised over time). However, it does not follow from this that it is necessary to use other methods of capitalization of differential rent in the economic evaluation of minerals than are used in the economic evaluation of other natural resources (e.g., land).

Geological prospecting work and the development of the mining industry exert a major influence (direct and indirect) on the environment and on natural resources. It is direct because the mining industry exerts an immediate influence on other natural resources and the environment: land, forests, water, and air. It is indirect because the development of a region frequently begins with the exploitation of mineral deposits. More than

700 new cities and city-type settlements have been created as a result of the development of deposits discovered and prospected during the years of Soviet power. (12)

The question of evaluating the poorest natural resources remains debatable. It seems to us that the expenditure concept should be used in this case. However, the point at issue must be price rather than evaluation. The price of the poorest natural resources is determined by the cost of their development, detection, and prospecting. It is advisable to differentiate these categories: the economic evaluation of natural resources proper and the price of products of labor in the primary branches of material production (branches that utilize natural resources) — agriculture, forestry, and the mining industry.

Economic evaluation is determined on the basis of the capitalization of differential rent, i.e., the excess over average profit that is derived from using resources with the relatively best natural conditions and factors. Labor expended on the development of plots of land and the exploration and prospecting of minerals is productive and creates value. Value and its monetary expression — price — reflect the expenditures of live and embodied labor that are entailed in the discovery and development of the given natural resources but do not reflect the evaluation of natural resources proper. It must be counted among the items of expenditure on the exploitation of natural resources and is part of the enterprise cost of production and the production prices of the corresponding primary branches of production.

Thus, surveyed mineral deposits can be considered the final product of a branch of the material sphere — the output of the geological prospecting branch. Accordingly, their price is determined by socially necessary expenditures of live and embodied labor on geological prospecting work.

The price of deposits prepared for exploitation and of deposits in various stages of exploitation is calculated on the basis of socially necessary expenditures on geological prospecting work and the preparation of deposits for exploitation with due regard to productive capital in evaluations based on replace-

ment value. The price of deposits characterized by more favorable natural conditions and factors includes their economic evaluation as an additional part of the profit.

The economic evaluation of natural resources permits the more complete consideration of the magnitude and structure of national wealth and makes it easier to prepare a cadaster of natural resources that not only must reflect their condition but must provide a characterization making it possible to judge their suitability for satisfying national economic requirements and the future availability of natural resources.

The economic evaluation of natural resources also holds great importance for the improvement of forecasting and long-range planning and for the elaboration of comprehensive scientific-technical, economic, and social programs. The use of the economic evaluation of natural resources in planning will provide better substantiation for condemning farmland for nonagricultural needs, selecting an effective system for working deposits, determining the feasibility of condemning areas for use as reservoirs, etc.

The incorporation of the national economic effectiveness of geological prospecting operations as an indicator in planning and economic practice will permit a significant increase in the impact of the economic mechanism on improving the quality of geological prospecting and will bring cost-accounting interests and national economic interests closer together. The national economic effectiveness of geological prospecting operations is evaluated according to the significance that the exploitation of a given deposit holds for the satisfaction of the requirements of the national economy.

Unlike the extractive branches of industry, the volume of expenditures on geological prospecting work does not depend on the quality of mineral and raw material resources, the size of the deposits, and their proximity to the regions in which they are consumed. Prospecting and exploration costs per unit of mineral reserves surveyed in various industrial categories constitute the indicator that characterizes the results of the economic-financial activity of a geological prospecting enter-

prise in a given area or deposit. It is determined by the volume and quality of fulfillment of a geological target and by expenditures on geological prospecting work, and it is used to compute the branch economic effectiveness of geological prospecting work. Nonetheless the use of this indicator does not make it possible to evaluate the factors that characterize the economic value of a deposit to the national economy and the expedience of its prospecting and preparation for exploitation in the planned period.

The basic task of calculating the effectiveness of geological prospecting work is to ascertain the national economic significance of a deposit and the expedience of allocating funds to prospect it and prepare it for exploitation.

We share the view that it is feasible to determine the national economic effectiveness of geological prospecting work on the basis of the ratio of the economic evaluation of deposits to the sum of expenditures on geological prospecting work and capital investments in the development of deposits. (13) Establishing an optimal sequence for prospecting and working deposits is closely associated with determining the national economic effectiveness of geological prospecting work. It is particularly difficult to ascertain forecast reserves that are the result of the discovery of new deposits. What is more, forecast reserves that have a low degree of probability must be several times higher than commercial reserves. However, exploratory work in a number of regions is partially replaced by prospecting work, so that the target of increasing reserves in commercial categories can be met. This leads to the unsatisfactory preparation of promising structures for prospecting, an increase in time and per unit expenditures on the latter, the scattering of geological prospecting operations over a large number of structures without sufficient regard to their potential, and consequently, the transfer of deposits that are unprofitable for future exploitation to the balance sheet of surveyed reserves.

The effectiveness of capital expenditures is raised mainly by concentrating capital investment and work on the most productive and most conveniently situated deposits. Accordingly

it is advisable to determine the economic evaluation of deposits and the national economic effectiveness of geological prospecting operations in their earlier stages. As a result it becomes possible to avert the premature prospecting of deposits that are not sufficiently profitable to be worked in the future and, consequently, to concentrate resources on the prospecting of deposits whose exploitation is essential to satisfying the requirements of the national economy and is stipulated in the state plan.

The lack of profitability in future national economic utilization is not the only reason for long delays in working already prepared deposits. Another reason is the disparity between expenditures on geological prospecting work and capital investments in the mining industry. As a result of the lack of coordination between plans for the detailed prospecting and extraction of mineral resources, the long-range plans for geological prospecting frequently call for the detailed prospecting of deposits that cannot be developed (after the prospecting work is completed) by industry as a result of the lack of the necessary funds, the absence of productive and nonproductive infrastructures, and the lack of customers. This shows the advisability of securing a greater degree of balance in the development of geological prospecting and the mining industry, the plans for the development of the given branches, and the plans for the development of territorial production complexes. Plans for geological prospecting work must be developed as an integral part of comprehensive plans for the development of the corresponding branches of the mining industry and comprehensive plans for the economic development of each region.

The ratio of surveyed reserves to quantities extracted is most widely used to determine the national economy's requirement for mineral raw materials and fuel. Surveyed reserves must be sufficient for the planned and forecast volume of extraction with due regard to the necessary time lag. At the same time, the excessively high volume of reserves surveyed in various industrial categories entails the unsubstantiated expenditure of labor, material, and monetary resources; conversely,

a low volume impedes the development of the mining industry and, as a consequence, of the national economy as a whole (in the absence of foreign trade turnover).

It is obviously advisable to create long-range reserves of mineral raw materials and fuel chiefly as a result of exploratory and preliminary prospecting operations. However, the time of detailed prospecting of deposits must be resolved simultaneously with the compilation of the long-range plan governing their exploitation. Thus it would be possible to integrate individual phases and stages of the work in order to reduce the disparity in time between the prospecting of a deposit and its industrial development. In the case of a deposit receiving a high economic evaluation, it would be possible to begin work on preparation for its industrial development and to build roads, production and residential buildings, and electric power plants even before the prospecting of the deposit is completed. The ultimate result is a considerable saving of funds on the construction of housing for prospecting personnel, the retention and training of personnel for a future mining enterprise, and accordingly the possibility for the early exploitation of prepared reserves. In this regard it is evidently expedient to transfer the detailed prospecting for certain minerals to the charge of appropriate ministries in the extractive industry, thereby making it possible to eliminate disproportions between detailed prospecting and exploitation and in addition to concentrate the attention of the USSR Ministry of Geology on exploratory work, on improving the preparation of structures for prospecting, and on mineral conservation problems. This can be promoted by the establishment of direct cost-accounting relations between the geological prospecting service and the extractive industry based on the transfer of surveyed deposits to the balance sheet of extractive enterprises with the appropriate cost assessment, which will make it possible to provide geological prospecting organizations with stronger economic motivation to reduce the volume of incomplete production and to concentrate resources on the prospecting of deposits that are more suitable for exploitation.

It is also essential to improve the system for the financing

of geological prospecting operations. They are now financed both from the budget and from capital investments. The existence of two sources of financing leads to the division of the geological prospecting plan into two parts and is one of the reasons behind the scattering of funds, the long interruptions between various phases of the work, and the slackening of the monitoring of the fulfillment of the plan for exploring and prospecting deposits. At the same time, from an economic standpoint expenditures on geological prospecting operations are capital investments in the mining branches. Their financing from the operational funds of the state budget distorts the actual magnitude of expenditures of social labor on the satisfaction of the requirement for a given type of mineral raw material and does not promote the more purposeful and effective use of these funds. For this reason, attention is merited by the proposal to plan allocations for geological prospecting operations as a part of the capital investments in the development of branches of the mining industry but to list them on a separate line. Thus surveyed mineral reserves will receive a valuation which will permit their more rational utilization and the creation of additional prerequisites for establishing direct cost-accounting relations between geological prospecting output and the mining industry. It is also expedient to provide possible directions for using bank credit by geological prospecting organizations by analogy with capital construction.

The July 12, 1979, decree of the Central Committee of the CPSU and the USSR Council of Ministers devoted much attention to securing the rational use of natural resources. At the same time, special significance is acquired by the reduction of losses of mineral resources in the extraction process, since mineral resources are practically nonreproducible; the level of capital intensiveness of the extraction of the most important types of minerals is usually significantly higher than in corresponding production facilities engaged in the processing of mineral raw material (in the case of oil – almost four times higher; metal ores – more than two times higher; petrochemical raw materials – two times higher). (14)

Given the present scale of extraction and processing of minerals, a mere 1% saving of raw material and fuel is the equivalent of drawing an additional 2 million tons of iron ore, approximately 5 million tons of oil, up to 5 billion cubic meters of natural gas, almost 7 million tons of coal, etc., into the production sphere. For example, losses of potassium salts in the ground in the Starobinsk deposit in the Belorussian SSR amounted to 260 million tons, while the quantity extracted was 170.4 million tons; thus losses were more than 60% of the total amount of balance sheet reserves of this valuable mineral resource, which were taken off the books. (15)

However, these losses are not reflected in the technical-economic work indicators of mining enterprises. The reduction of losses of mineral resources in the ground is both a technical and an economic problem. This problem can be resolved above all through the improvement of existing and the introduction of new, progressive techniques for working deposits, new equipment and technology, the construction of special enterprises for processing and using the associated components. Solving this problem requires additional expenditures, the economic effectiveness of which frequently cannot be substantiated due to the absence of a monetary valuation of mineral resources. The result is delay in the introduction of new methods, progressive exploitation techniques, and the insufficient economic motivation of mining enterprises to use them.

A considerable percentage of the losses of mineral resources in the ground is associated with the insufficient utilization of the associated components. The systematic increase in the requirement for mineral resources results in the exploitation of deposits with a low payload. Thus the iron content in crude ore was 50% in 1950, 44.5% in 1960, 37.3% in 1970, and 35.1% in 1980. (16) The decline in the content of the major useful component leads:

— to an increase in the extraction of material per ton of payload. Thus the expenditure of raw ore per ton of iron in commercial ore increased 1.3 times (from 2.6 to 3.3 tons) between 1966 and 1977. In 1977, 1.3 billion tons of material were ex-

tracted from the ground. They contained 37% ore mass, 19% commercial ore, while 11% was iron in commercial form;

— to an increase in the investment-output ratio of extraction. For example, per unit capital investments to increase the production of crude iron ore rose to 102 rubles per ton in the Tenth Five-Year Plan, compared with 61 rubles per ton in the Eighth Five-Year Plan (17);

— to an increased impact on the environment and higher costs of protecting the environment. Outlays on the transporting of tailings and on the maintenance of tailing facilities constitute up to 8-10% of the enterprise cost of production of commercial ore. (18)

The volume of extraction of material can be reduced through its more complete utilization. There are virtually no deposits that contain only one useful component. Thus iron ores contain ten other useful components in addition to iron (vanadium, cobalt, copper, germanium, phosphorus, sulfur, tantalum, niobium, zirconium, titanium), the reserves of which are of particular national economic significance. Nonetheless, of 53 existing iron ore enterprises, only seven are now engaged in the complex exploitation of deposits. (19) In order to increase the economic motivation for the comprehensive exploitation of mineral deposits, it would be a good idea to make an economic evaluation of deposits and to include not only the basic component but accompanying components as well.

The transfer of surveyed deposits to the balance sheet of mining enterprises at a price that includes the appropriate economic evaluation should be made gradually for individual types of the scarcest minerals in order to avoid a sharp increase in prices. At the same time, it should be considered that the use of the economic evaluation of natural resources in national economic practice strengthens the cost-accounting stimuli for rational natural resource utilization and ultimately promotes the reduction of losses of natural resources, the reduction of the material intensiveness of social production and the enterprise cost of production, and the lowering of prices on the output of the extractive branches.

However, we should also not exaggerate the importance of the economic evaluation of natural resources. This is only one of the indicators that facilitates the solution of the problem of strengthening economic stimulation and increasing the national economic effectiveness of their utilization. In planning, in the implementation of planning decisions, and in the elaboration of special comprehensive programs, this indicator can be used only in conjunction with other technical-economic and social indicators and characteristics, such as the enterprise cost of production, the profitability of production, the existence and intensiveness of the utilization of fixed capital, the existence of a prepared productive and nonproductive infrastructure and skilled cadres, the existence of customers, outlays on environmental protection, and the long-term availability of a given type of natural resource to the national economy, etc.

But on the whole, the use of the economic evaluation of natural resources in planning and in national economic practice must strengthen the influence of the economic mechanism on increasing the social and economic effectiveness of natural resource utilization.

Notes

1) See Academician S. G. Strumilin, "K otsenke darovykh blag prirody," Izbrannye proizvedeniia, vol. 1, "Nauka" Publishers, 1964; Academician T. S. Khachaturov, Sovetskaia ekonomika na sovremennom etape, "Mysl' " Publishers, 1975; Academician T. S. Khachaturov, Intensifikatsiia i effektivnost' v usloviiakh razvitogo sotsializma, "Nauka" Publishers, 1978; Academician T. S. Khachaturov, Effektivnost' kapital'nykh vlozhenii, "Ekonomika" Publishers, 1979; Academician N. P. Fedorenko, Aktual'nye problemy ekonomicheskoi teorii, Politizdat, 1973; "Vremennaia tipovaia metodika ekonomicheskoi otsenki mestorozhdenii poleznykh iskopaemykh," GKNT SSSR i Goskomtsen SSSR, Moscow, 1980; K. G. Gofman, Ekonomicheskaia otsenka prirodnykh resursov v usloviiakh sotsialisticheskoi ekonomiki, "Nauka" Publishers, 1977; M. N. Loiter, Prirodnye

resursy i effektivnost' kapital'nykh vlozhenii, "Nauka" Publishers, 1974; also see the discussion in the journal Voprosy ekonomiki between 1967 and 1969.

2) See S. G. Strumilin, "O tsene 'darovykh blag' prirody," Voprosy ekonomiki, 1967, no. 8, p. 60.

3) K. Marx and F. Engels, Sochineniia, vol. 25, part 2, p. 172.

4) Ibid., vol. 23, p. 112.

5) Ibid., vol. 25, part 2, p. 198.

6) V. I. Lenin, Polnoe sobranie sochinenii, vol. 1, p. 100.

7) Marx and Engels, p. 402.

8) T. S. Khachaturov, Intensifikatsiia i effektivnost' v usloviiakh razvitogo sotsializma, "Nauka" Publishers, 1978, p. 289.

9) Ibid.

10) During the first one to three years of exploitation of deposits, expenditures on extraction may be higher than the maximum allowable expenditures, but this period should not be taken into account in the economic evaluation of a deposit and should be considered the period of development.

11) E. A. Kozlovskii, "Mineral'no-syr'evaia baza i faktor vremeni," Sovetskaia geologiia, 1979, no. 3, pp. 9-22; A. Ia. Kats, "Metod ucheta faktora vremeni pri razrabotke konditsii na mineral'noe syr'e," Sovetskaia geologiia, 1979, no. 9, pp. 12-18.

12) A. V. Tomashevich, Ekonomicheskaia otsenka mineral'nykh resursov Belorussii, Minsk, 1978, p. 11.

13) Iu. A. Sokolovskii, "Nekotorye aspekty opredeleniia ekonomicheskoi effektivnosti geologorazvedochnykh rabot," Sovetskaia geologiia, 1979, no. 7.

14) See Voprosy ekonomiki, 1979, no. 7, p. 68.

15) See A. V. Tomashevich, Ekonomicheskaia otsenka mineral'nykh resursov Belorussii, Minsk, 1978, p.45.

16) See A. Tselikov, "Ekonomiia metallov pri novoi tekhnologii," Planovoe khoziastvo, 1979, no.8, p. 56.

17) Ibid.

18) See M. Sergeev, "Ispol'zovaniiu vtorichnykh resursov gosudarstvennyi podkhod," EKO, no. 8, p. 51.

19) See Ekonomika i organizatsiia promyshlennogo proizvodstva, 1979, no. 8, p. 54.