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Assessment of the Impact of Mining Indicators on the Efficiency of a Mining Enterprise

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Abstract

In this article, the factors affecting the economic indicators of a mining enterprise in the extraction of minerals are studied and analyzed in detail. Based on the analysis, the importance of indicators of loss and dilution not only in the economy of the enterprise, but also the socio-environmental impact is highlighted. It is also noted that reducing the indicators of loss and dilution is the most optimal way to increase the productivity of a mining enterprise.

Keywords: Ore, loss, dilution, efficiency, mining indicators, mining enterprise, extraction, useful component, cost, economy.

Introduction

During the current complex international energy crisis, the mining industry is important, providing raw materials for fuel and energy, production and many sectors of heavy and light industries. In the current year, the share of the industrial sector in the country's GDP was 26.1%, of which the indicator of mining and metallurgical sectors is 13.13% [1]. This means that the field of Mining-Metallurgy ranks high among all industries.

Increasing the productivity of the mining and metallurgical industry is carried out at the expense of increasing the technical and economic indicators of mining enterprises. The effectiveness of mining mineral deposits depends on several factors, the analysis and management of which has a positive effect on the activities of the mining enterprise[2-4]. These factors are: price, cost, dilution, loss, useful component extraction factor, average amount of useful component, and labor cost.

Price is one of the main factors that most affect the activities of the enterprise economically, and is characterized by frequent changes in the world market. Monitoring the change in the value of Mineral raw materials and finished products, the implementation of important measures will make it possible to avoid negative consequences that may occur in the future. Below is a graph of the dynamics of the change of the price of gold in the world market for 10 years[5](Figure 1).

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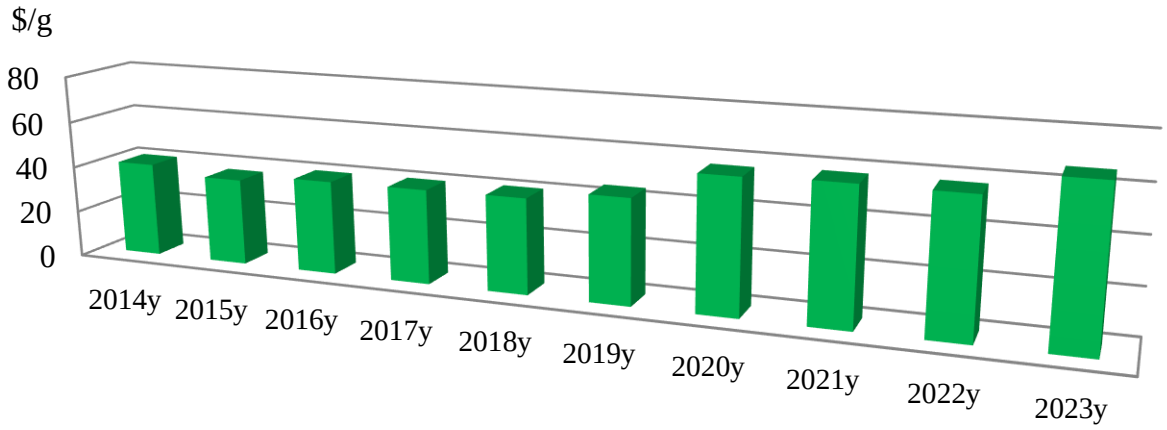

Figure 1. Graph of the change in the price of gold in the world market during 2014-2023

Costs are the main factor that directly affects the efficiency indicator and determines the cost of products. The cost of tools and services used by a mining enterprise, as well as the continuous variation of exploration, mining operations, mining-geological conditions, is the reason for a large increase in total spending. The ratio of costs for production and the cost of mineral raw materials or finished products is an indicator that reflects the activities of the enterprise. In the developed countries of the mining industry, this figure is 0.2 - 0.6.

Dilution is one of the main indicators that characterize the indicators of the extraction of minerals. Dilution combined with ore causes an increase in excess unproductive costs for mining, transporting and processing waste rocks to an enrichment factory as well as the volume of mining operations to achieve the planned amount of metal, causing significant economic damage. The profit received by a mining enterprise is disproportionately reduced to it as the degeneration of the ore increases (Figure 2). Reducing the quality by 1% causes the cost of ore to be reduced by 3.8%. According to the calculations, 1% of the loss from dilution is greater than the loss from 1% loss, which varies according to mining systems[6].

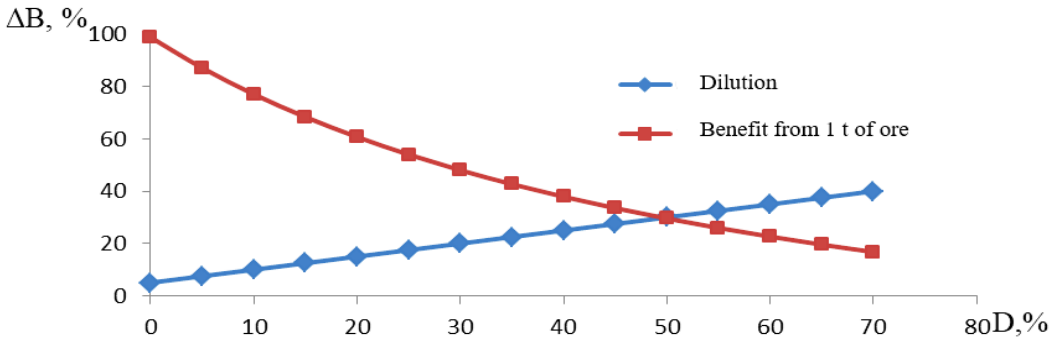

Figure 2. Graph of the effect of dilution on the benefit of the enterprise

Loss directly affects the activities of a mining enterprise, representing the level of rational use of the Earth's crust. Funds allocated for the exploration of the mine, excavation, construction of a

mining enterprise, the creation of infrastructure, capital investments are inefficient in a certain amount as a result of loss. Alternatively, the loss will cause a decrease in the productivity of the mining enterprise, a decrease in the balance reserves, as well as the length of service in the plan. As the loss increases, the profit that a mining enterprise receives decreases in reverse proportion (B~1/L) to it. All of the above negatively affects mining enterprise's ability to compete in the world market, leading to an increase in the cost of finished products.

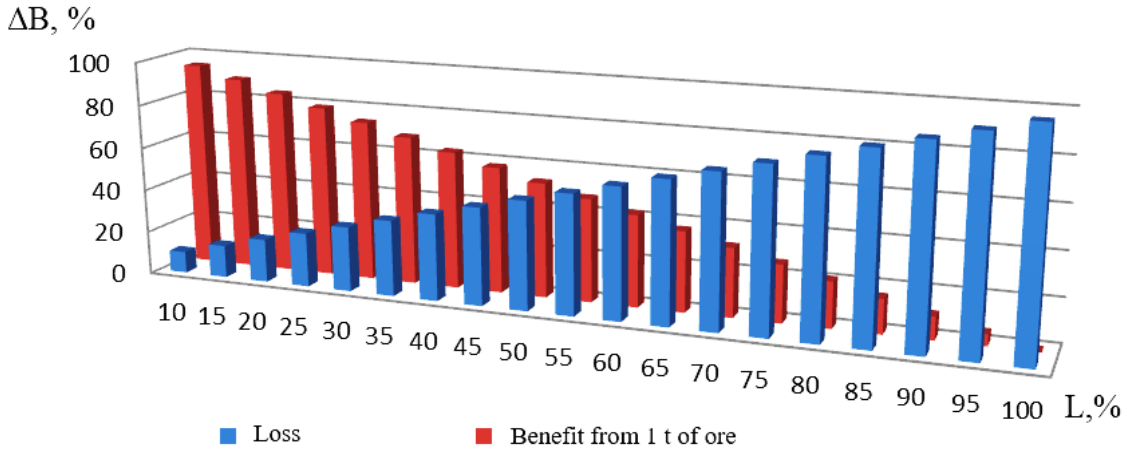

Figure 3. Graph of the impact of loss on the benefit of the enterprise

The degree of extraction of a useful component is as important as the above-mentioned factors, directly affecting the effectiveness of the activities of the entire mining and metallurgical complex. While all production processes of mining mineral deposits have high indicators, the fact that the extraction of a useful component in the enrichment process is at a low level causes the cost of the finished product to remain high. The degree of extraction of the useful component varies from 60% to 95% depending on a number of indicators, including the chemical, mineralogical and granulometric composition of the ore, density, strength and the presence of harmful additives[7-8].

The average content of the useful component is considered one of the main indicators that determine the quality of the ore mass, the amount of this indicator depends primarily on the determination of the balance reserves contour limit and is determined during the period of geological and economic assessment of the mine. Ensuring the permanence of the amount of useful component is among the main tasks before the mining industry. Changes in the consistency of the ore component cause a decrease in metal extraction rates in enrichment and metallurgical processes[9-10]. The effect of a 1% deterioration in ore component permanence on the metallurgical process is estimated to be equivalent to the economic damage caused by a 2.5% reduction in ore containing metal. The stability of the useful component composition has a positive effect on the effectiveness of technological processes, ensuring the operation of the processing network in an unchanged order.

Labor consumption is one of the indicators that assess the efficiency of mining, expressed in the unit of labor and time spent on the extraction of a mass of 1000 t ore. Achieving relatively high extraction rates through low labor costs will cause savings in the funds allocated by the mining enterprise for salary, energy, material consumption and amortization. When determining labor

costs for the mining method, it is also necessary to take into account the degree of loss and dilution. While the reduction in losses in turn affects the reduction in labor costs as well, the dilution of the ore leads to the waste of ore, transport, excess time for processing, and labor. And all this causes an increase in unproductive costs for the enterprise[11-13].

The factors listed above represent the overall effectiveness of a mining enterprise by directly influencing the work of mining and enrichment of minerals. According to the results of the analysis, indicators of loss and dilution not only significantly affect the effectiveness of mining enterprise, but also determine the range of change of other factors. Lowering the dilution of ore by 10-40% will cause the cost of the finished product to decrease by almost twice. No technical and economic measures, whether in the process of mining or in the process of enrichment, will be able to ensure the efficiency achieved in reducing the dilution and loss of ore.

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