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INCREASING THE EFFICIENCY OF KRYVYI RIH MINING AND ORE-DRESSING ENTERPRISES BY OPTIMIZING PRODUCTION COSTS

Formulation of the problem. One of the main purposes of economic entities in the current market conditions in accordance with the State program enhancing economic development for 2013-2014, approved by the Cabinet of Ministers of Ukraine № 187 dated 02.27.2013, is increasing the efficiency of its activities, ensuring the improvement of overall enterprise competitiveness [1]. The effectiveness of the enterprise is characterized by the ratio of the effect (the result) to the cost of the resources that are spent to produce it. Therefore, it should be noted that the process of determination and optimizing costs plays a leading role in ensuring financial stability as a major internal reserve for this.

Peculiarities of accounting and determination of production costs depend on the characteristics of the production process, from which a certain way of calculation is selected. In this paper, attention is paid to the analysis of the production costs of mining and ore-dressing enterprises to identify opportunities to optimize it taking into account qualitative indices and pricing that provides the appropriate level of efficiency. That is the purpose pursued by mining and ore-dressing enterprises of Kryvyi Rih iron ore basin. This will enable enterprises to realize placed under the "Strategic plan of development of Kryvyi Rih to 2015" environmental and social programs. [2]

One of the key directions of effective management in current environment is successfully designed and organized system of cost management. Recently, more attention is paid to the issue of cost management that must be focused on industry particularities of enterprises. Inadequately selected and organized system of costs accounting can lead to undesirable consequences. Relevance of the research is determined by the need to study diagnostic features of the formation of the costs of mining and ore-dressing enterprises and finding rational ways to optimize it.

Analysis of recent research and publications. The problem of basics of nature, classification and management of the enterprise cost is the subject of attention of many researchers and practitioners. Both foreign and national experts study these issues: N. Ivanyuta, F. Butynets, T. Voytenko etc., but taking general scientific approaches in solution of the problems of enterprise costs optimization as a basis, specific mechanisms of costs formation, its management, and search of reserves to reduce costs at specific enterprises are not studied sufficiently and require further research.

It is known that the main indices of the enterprise activity effectiveness are profit and profitability. An important factor that affects the amount of profit and identifies the level of profitability is the change of production expenses and costs. If the change in production output and sales directly affects the size of sales proceeds and as a result the efficiency of activity, the relation between the size of profits and the level of expenses and the level of costs inverse [3]. However, this factor is influenced by many other factors. Among them different factors may be defined depending on the industries in which the economic entity carries out its activity, but the level of the cost of raw materials, the labour and social costs, technology and other energy costs are the main [4].

When choosing a method of costs accounting the peculiarities of production process of mining and ore-dressing enterprises of Kryvyi Rih iron ore basin should be taken into account, the main ones are: large production volumes, staged structure of the production process, long distance between certain production units, large consumption of materials and energy, the ability to sell products at the foreign market as commodities of full value. [5]

Butynets F.F. pays special attention to staged method in his research, mentioning that semi-finished products take an important place in the formation of the costs [6]. Analytical accounting of the production costs can be performed by objects of calculation, which is an advantage of this method. It is assumed that staged method is complex and time consuming, requiring additional accounting expenses both for stages and different types of products [7].

The main methods of survival and maintaining the competitiveness of enterprises of mining and ore-dressing industry consider maintaining a certain level and increasing production output and reproduction and expansion of production capacity [8]. However, along with this the need to find reserves to reduce production costs may be the key in efficiency improvement.

An important aspect of the calculation of the costs of mining and ore-dressing enterprises is the allocation of general costs of production; its features are determined by the nature of the technological process and organizational structure of the industry. [9] The main problem while allocation is the lack of operative account that means complete data on the actual costs of production units may be got at the

accounting department in a month after the reporting month. The data at the time of receipt will be obsolete and will not allow to analyze production processes in departments and, therefore, take managerial decisions to overcome problems [10].

Target setting. In current economic situation costs accounting for production and formation of production costs is an urgent problem for mining and ore-dressing enterprises. Costs reduction and optimization allows the enterprise to gain more profit from its activity, or have significant competitive advantages in the markets. In the process of costs optimization the main aspect is the improvement of the production efficiency and product quality conservation, what suggests an increase in productivity, conservation of raw material and energy resources, improvement of the use of fixed assets. The purpose of research was to identify opportunities to optimize costs in the production of iron ore products. To achieve the purpose the following tasks were carried out: - a comparative analysis of cost of production and the cost of iron ore products of the mining and ore-dressing enterprises of Kryvyi Rih iron ore basin; - determination of the effect of qualitative products to the level of costs and price; - identification of reserves to reduce production costs. The object of the research was the production costs, and the subject - search for organizational measures to optimize its value for mining and ore-dressing enterprises.

Material presentation. The main enterprises of Kryvyi Rih iron ore basin, dealing with the processing of raw ore by enrichment and pelletizing methods are Nothern GOK, Central GOK, Southern GOK, Ingulets GOK and the Department of Mining of PJSC "ArcelorMittal Kryvyi Rih" (AMKR). Enterprises of mining and ore-dressing complex of Kryvyi Rih iron ore basin are engaged in production and sale of the following products: saleable concentrate, pellets and sinter. The analysis of the costs of saleable concentrate for the years 2009-2012 is presented in Table. 1.

The tendency of changes in the cost of saleable concentrate can be described as follows: in 2009-2011 it is observed its increase, and at the end of 2012 – decrease. According to these data, in 2009, the largest cost of saleable produce was at Ingulets GOK and reached 386.77 UAH/t, 2010 – Central GOK (650.43 UAH/t), 2011 – Ingulets GOK (1030.47 UAH/t) and in 2012 the highest costs of concentrate was observed at Southern GOK, which amounted to 732.81 UAH/t.

Table 1

Dynamics of changes in the cost of saleable concentrate, UAH.

Saleable concentrate	2009	2010	2011	2012	Absolute variation	
					2012/2009	2012/2011
Central GOK	372,07	650,43	957,74	727,79	355,72	-229,95
Nothern GOK	287,00	548,21	870,74	620,57	333,57	-250,17
Southern GOK	256,62	640,61	1011,56	732,81	476,19	-278,75
Ingulets GOK	386,77	613,43	1030,47	743,34	356,57	-287,13

Compiled by the authors based on [11]

Two enterprises in the region are engaged in production of pellets: Central GOK and Nothern GOK. The dynamics of changes in the cost is shown in Fig. 1. In 2009-2011 Nothern GOK has a lower cost for this type of product than Central GOK.

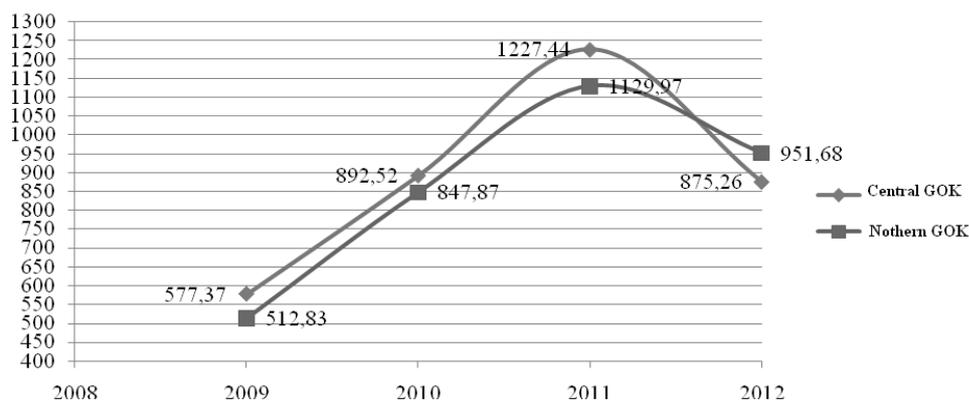


Fig. 1 – The dynamics of changes in the cost of pellets (UAH) in 2009-2012 at Central GOK and Nothern GOK (formed by the authors based on [11]).

The basic amount of the saleable sinter is produced by Southern GOK. The cost of sinter in 2009 amounted to 421.7 UAH/t, in 2010 it increased 223 UAH, to 644.7 UAH/t. In 2011, the cost of sinter was 996.3 UAH/t, an increase compared with 2010 to 315.6 UAH/t. In 2012 the cost of 1 ton of sinter decreased 277.16 UAH, to 719.14 UAH.

Based on the fact that all mining and ore-dressing enterprises in the region are engaged in production of saleable concentrate, further research to compare, identify possible cost-cutting and other reserves for increasing efficiency of production should be focused precisely on this type of product.

Different cost of concentrate for different enterprises is due to the peculiarities of technology of iron ore mining, preparation and its enrichment. And not only cost (C) determines the price (P) of the product, but also its qualitative properties – such as iron content (Table 2).

Table 2

Relation of quality, cost and price of concentrate

Enterprise	Iron content, %	2009		2010		2011		2012	
		C 1t, UAH	P 1t, UAH	C 1t, UAH	P 1t, UAH	C 1t, UAH	Ц 1t, UAH	C 1t, UAH	Ц 1t, UAH
Ingulets GOK	65,35	386,77	408,91	613,43	608,31	1030,47	1037,04	727,79	740,42
Southern GOK	66	256,62	259,02	640,61	628,7	1011,56	1013,42	620,57	738,58
Nothern GOK	68,4	278,43	291,06	548,21	525,49	870,74	860,86	732,81	944,65
Central GOK	66,6	372,07	363,91	650,43	642,35	957,74	959,85	743,34	875,26

Compiled by the authors based on [11]

As it may be seen the highest iron content for this type of products is 68.4%. But the ways to achieve this index are not effective, because by iron ore enrichment and increase in iron content its costs increases, what is a negative trend in the enterprise activity and needs to find reserves to reduce costs while increasing quality. Analyzing the quality and price of concentrate in 2012 (Fig. 2), it should be noted that the most effective is the activity of Nothern GOK and for Ingulets GOK value for money (especially in 2011) is not perfect.

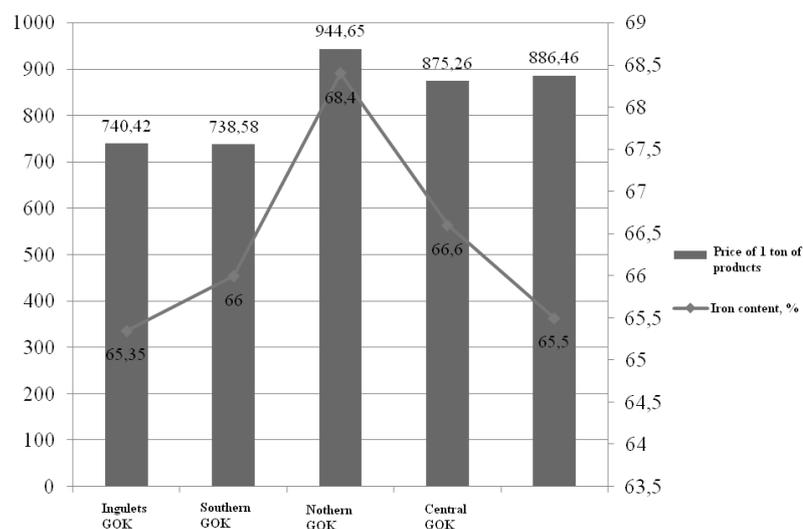


Fig. 2 – Iron content and price of 1 ton of concentrate (UAH) in 2012.
(formed by the authors based on [11]).

Cases when the product price is lower than its cost, is a negative manifestation of the activities of any enterprise. Thus, Southern GOK sold in 2010 its products at a price 628.7 UAH per ton at a cost – 640.61 UAH. Nothern GOK sold concentrate at a price 525.49 and 860.86 UAH at production costs 548.21 and 870.74 UAH respectively in 2010-2011, in 2009-2010 Central GOK sold concentrate product below its costs.

Mining department of PJSC “ArcelorMittal Kryvyi Rih” is also engaged in production of saleable concentrate in the Dnipropetrovsk region (Table 3).

Table 3

Production of concentrate AMKR

Period	Production output		Share in total production output, %	Costs of 1t, UAH
	tons	thousand UAH		
2010	1804007	1250420,3	5,5	693,13
2011	2835021	2490417,4	8,6	878,45
2012	2172729	1490409,9	5,2	685,96

Compiled by the authors based on [11]

Share of saleable concentrate in total production output at AMKR is much lower (5-9%) than in the mining and ore-dressing enterprises of the region (over 20%), with an average iron content of 65.5%. It should be noted that in 2009 AMKR was not engaged in production of saleable concentrate that does not allow to carry out the analysis of dynamics of price and production costs compared with enterprises of mining and ore-dressing combines fully.

Analyzing the dependence of the cost of concentrate for the entire output and 1t (Table 4) it may be seen that unit costs increased for all enterprises by 2-3 times.

Table 4

Combined table of costs of concentrate at mining and ore-dressing enterprises in 2009 and 2012

Enterprise	Central GOK		Nothern GOK		Southern GOK		Ingulets GOK	
	2009	2012	2009	2012	2009	2012	2009	2012
Total costs, million UAH	1001,15	2852,09	1079,27	2331,16	1634,03	6531,91	4342,49	10099,67
Costs 1t, UAH	372,07	727,79	287,00	620,57	256,62	732,81	386,77	743,34

Compiled by the authors based on [11]

Increase in the total costs of production depends on two factors: the amount of products and the cost of 1 ton of products. To determine the effect of production costs, rate of growth of costs of production unit and total costs were compared (Fig. 3).

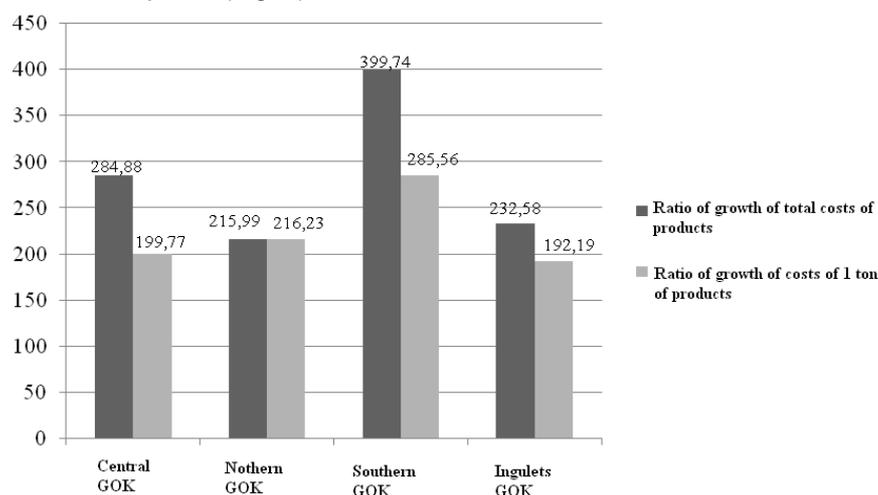


Fig. 3 – Comparison of rates of growth of costs during 2009 and 2012
(Development of the authors)

At Nothern GOK, expansion of cost of 1 ton of products and the total cost is almost the same (216.23 and 215.99%), while for other enterprises excess of ratio of growth of total production costs is typical, caused by increase in production for the period.

Using factor analysis, it is possible to determine the effect of changes in the cost of 1 ton of products on the size of the total costs of production. For the analysis used data in Table 5.

Table 5

Starting data for carrying out factor analysis

Enterprise	C 1 t of products, UAH		Total costs, thousand UAH		Δ Total costs	I _c 1 t
	2011	2012	2011	2012		
Ingulets GOK	1030,47	743,34	14548145,9	10099671,2	-4448474,7	0,7214
Southern GOK	1011,56	732,81	8919127	6531902	-2387225	0,7244
Nothern GOK	870,74	620,57	2935163,2	2331157,3	-604005,9	0,7127
Central GOK	957,74	727,79	3707803,42	2852088,76	-855714,66	0,7599

(Development of the authors)

The influence of changes in the costs of 1 ton of products, and production output is presented in Table 6.

Table 6

The influence of factors on the change of total costs of production, thousand UAH

Enterprise	Due to changes in the cost of 1 ton ($\Delta C = C_1 - C_1 \cdot I_{CB}$)	Due to change in production output ($\Delta C = C_1 / I_{CB} - C_0$)	Sum
Ingulets GOK	-3900427,497	-548047,203	-4448474,7
Southern GOK	-2485080,33	97855,3302	-2387225
Nothern GOK	-939724,2771	335718,3771	-604005,9
Central GOK	-901153,4561	45438,79608	-855714,66

(Development of the authors)

According to the calculations, it should be noted that the reduction of the costs of saleable concentrate is primarily due to decrease in production unit costs. This trend is characteristic for each of the analyzed enterprises that may be caused by decrease in the value of the used resources. According to the index change in the costs of 1 ton of products, its reduction at Ingulets GOK is the smallest, what can be caused by a feature of the technological process used at the enterprise. Reduction of the costs of the saleable concentrate to -548,047.203 thousand UAH was due to a decrease in production output at Ingulets GOK during the reporting period, especially taking into account the fact that other enterprises increased production.

After analyzing the costs structure of saleable concentrate on Ingulets GOK for 2009-2012 (Table 7) it was found that the largest share of the costs is occupied by energy resources (up to 36% in 2011).

Table 7

The structure of the production costs of saleable concentrate in 2009-2012 at Ingulets GOK

№	Cost structure	Share in the total costs of sold products, %			
		2009	2010	2011	2012
1	Raw and basic materials	19,75	61	4,82	4,5
2	Auxiliary materials	5,45		14,21	13,86
3	Power resources	25,77	x	35,77	32,09
4	Depreciation	12,47	x	9,41	9,75
5	Salary	8,94	9	6,7	8,63
6	Allowances for salary	x	3	2,54	
7	External services	7,58	x	11,27	12,02
8	Taxes and charges	x	3	3,42	x
9	Other expenses	9	14	0,27	4,36
10	Administrative expenses	x	x	1,82	x
11	Distribution expenses	11,04	10	9,77	9,96
12	Fuel	x	x	x	4,83

x – there is no information about the value. Compiled by the authors based on [11]

Complexity of the analysis of the dynamics of the cost structure is in the presence of different data. Thus, in 2010 the share of raw materials is 61%, while energy resources, fuel and external services that took place in the production are not reflected, but likely they were included in this cost item. Taking this into account, a more detailed analysis of 2011-2012 was carried out, results of which are presented in Table 8.

Table 8

The dynamics of costs structure in 2011-2012 at Ingulets GOK

№	Cost structure	2011		2012		Variances 2012/2011	
		%	UAH	%	UAH	UAH.	Items of structure
1	Raw and basic materials	4,82	49,67	4,5	33,45	-16,22	-0,32
2	Auxiliary materials	14,21	146,43	13,86	103,03	-43,4	-0,35
3	Power resources	35,77	368,6	32,09	238,54	-130,06	-3,68
4	Depreciation	9,41	96,97	9,75	72,48	-24,49	0,34
5	Salary with allowances	9,24	95,22	8,63	64,15	-31,07	-0,61
6	External services	11,27	116,13	12,02	89,35	-26,78	0,75
7	Taxes and charges	3,42	35,24	x	x	x	x
8	Other expenses	0,27	2,78	4,36	32,41	29,63	4,09
9	Administrative expenses	1,82	18,75	x	x	x	x
10	Distribution expenses	9,77	100,68	9,96	74,04	-26,64	0,19
11	Fuel	x	x	4,83	35,9	x	x
12	Total	100	1030,47	100	743,34	-287,13	-

Development of the authors

Reducing the costs of 1 ton of saleable concentrate on 287.13 UAH is a positive trend in the enterprise activity that influenced all cost items. We will mention that the costs of sales decreased by 26.64 UAH, but their proportion increased from 9.77 to 9.96%. External services have the similar trend and increased by 0.75%, but in value terms decreased by 26.78 UAH. The greatest changes were in energy resources, which costs of 1 ton of concentrate decreased by 130.06 UAH, or 3.68%. This change may be caused by decrease in energy costs for the enterprise, or the use of cheaper energy resources. Other expenses increased by 29.63 UAH, from 0.27 to 4.36% in the cost structure. This may be due to the fact that administrative costs or taxes and charges were placed here and not reflected as a separate cost item in 2012, but present in the production. Depreciation of equipment decreased from 96.97 to 72.48 UAH, but its share in the cost structure has increased by 0.34%.

The need to reduce the costs of 1 ton of concentrate in the coming years is a prerequisite that will allow both analyzed enterprises and the whole industry to come out of crisis and make a significant step in achieving such goals as increasing the value of profits and improving efficiency.

For mining and ore-dressing enterprises, the main characteristic directions to optimize the cost can be as follows:

- 1) Reducing the costs of energy resources that occupy the largest share in the costs of production. This can be achieved by finding cheaper sources of energy, changes in technological processes that will allow to use cheaper energy sources or change the enterprise operating mode;
- 2) Reduce the share of external services replacing them by own production;
- 3) Reduce the costs of sales, due to changes in the supply circuit.

Conclusions of research. Thus, a comparative analysis of the costs of production and costs of different types of products of mining and ore-dressing enterprises of Kryvyi Rih iron ore basin, analysis of their dynamics, structure and codependency of consumable, price and quality parameters of activity of mining and ore-dressing enterprises of Kryvyi Rih iron ore basin allowed to find reserves to reduce costs of production of iron ore products, occupying the largest share of the cost. It should be noted that the above-mentioned directions of optimization are only short-term, because enterprises of the industry require significant capital investment that will allow to change the equipment and technology. Such step

requires significant resources and would increase the share of depreciation in costs, but at the expense of other expenditures and improvement of product quality, this decision will have a positive effect.

The prospect of further research of this issue consists in determining further reserves for optimization of production costs of enterprises, by modifying and improving the methods of calculation, the construction of an effective program of reorganization of enterprises and determining ways of updating and modernization of fixed assets, which will increase the efficiency of their management.

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Bondarchuk O.M., Goloborodko B.Yu. INCREASING THE EFFICIENCY OF KRYVYI RIH MINING AND ORE-DRESSING ENTERPRISES BY OPTIMIZING PRODUCTION COSTS

Purpose: The purpose of this paper is to identify opportunities to optimize costs in the production of iron ore products of mining and ore-dressing enterprises.

Methodology of research. It was used the analysis and synthesis of scientific, technical and economic information according to the issue of formation, evaluation and cost analysis in order to select promising directions of optimization at the industrial enterprises; methods of mathematical statistics - to assess the actual cost of production and the cost of iron ore products at the mining and ore-dressing enterprises of Kryvyi Rih; methods of economic analysis of production costs: a comparative analysis - to identify problems common to all companies in the region to form the production cost and identify dependencies between consumption, high quality and price indices of iron ore products; horizontal and vertical analysis - to identify the type of production cost of iron ore products, which occupies the largest share in the cost of production; factor analysis - to identify stocks of production costs of mining and ore-dressing enterprises decrease.

Findings. The dynamics of changes in the major products cost at mining and ore-dressing enterprises, the ratio of the value of costs, prices and products quality have been considered. On the basis of study the structure of production costs it was proposed to take measures for their reduction by optimizing the use of energy resources, which occupy the largest share in the production cost. It was detected reserves reduce costs of production of iron ore products that occupy the largest share in the cost. It has been established that the economic directions of costs optimization are only short-term. Enterprises in the industry should increase capital investments for implementation of progressive equipment and technology. It would require significant funds and would increase the share of depreciation in cost price, but by reducing other items of expenditure and increasing product quality, this decision will have a positive effect.

Originality lies in the further development of the basic general scientific approaches in dealing with cost optimization for specific enterprises taking into account the specific mechanisms of their formation and control. The measures to reduce costs of energy resources, which occupy the largest share in the

cost of iron ore products, which include search for cheaper sources of energy, change technological processes, change the operating mode the enterprise were proposed.

Practical value. The use in practice proposed measures at reducing costs of energy resources will increase the efficiency of mining enterprises of Kryvyi Rih.

Key words: industrial enterprise, production cost, costs, analyses, optimization, measures, efficiency.