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The Elasticity Estimation of the Business Value as a Tool of Factors Analysis of the Enterprises Development (on Example of Achinsk Alumina Combine)

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The business value models have found a wide application in the modern management of organization. They also can be applied to analyzing the technological efficiency based on the value elasticity coefficients. Some Russian alumina enterprises have obvious problems with further raw materials providing. This problem has technological and economic aspects. The enterprises such as Achinsk alumina combine are trying to solve a problem of involving worse quality raw materials into processing. In this paper the authors have attempted to adapt the Gordon's value model to the technological factor analysis. It allows taking into consideration the significant features of complex processing; and determining the possible consequences of the deterioration of key technological indicators. So, the authors emphasize the need of developing the economic instruments of estimating the multi-nomenclature technologies.

Keywords: business value, Gordon's model, elasticity coefficients, complex raw materials, Achinsk alumina combine

Introduction

The business value estimation methods have found wide application in modern management of organization. There are different approaches considering separate aspects of the value basis managing. It is necessary to note that each of the existing approaches is not independent. It is possible to offer the following classification of approaches to management on the basis of business value estimation:

- approaches which consider modelling of business value as a tool to analyze the enterprise development factors. I.Egerev

and S.Mordashov's approaches are to be mentioned among this group;

- approaches which consider a problem of stability and balanced growth of company value. The studies of K.Uolsh and A.Damodaran form this group;
- approaches considering an estimation problem of a business evolution scenario. T.Kouplend, T.Koller, J.Murrin's works, along with the works of R.Brejli, S.Myers form this group;
- approaches, which are based on financial and economic analysis of the company.

According to this approach the company value increase is connected with improvement of financial and industrial parameters in the first place. There are, for example, the M.Bertonesh, R.Knight and Y.Kozyr's researches in this group. All the approaches in the aggregate make the more or less complete business management system which is focused on the value growth.

T.Kouplend, T.Koller and J.Murrin were one of the first to offer the business value estimation as a complex of the efficiency parameters of the company baseness value, and basic guideline in management [5]. The essence of the given approach is to define the gap between the company value in the share market and its internal value counted by an income flow capitalization. The company's management should develop the consecutive plan of internal and external improvements to reduce such gap. However, there are the specific tools of estimation and analysis of the company value presented in a less degree in approaches of those authors.

The profitable approach advantages, founded by I.Egerev and S.Mordashov, are used to business valuation, on which basis the tools of analysis for purposes of managing are offered [9, 10]. The authors offered the mathematical model of company value and spent the factors elasticity analysis specifying separate parameters of Gordon's model. The calculation of value elasticity coefficients for a company allows investigating a potential deviation of business value by changing one of parameters.

K.Uolsh and A.Damodaran consider a problem of balanced growth of the separate value model parameters. K.Uolsh approves that it is necessary to be guided by internal company potential, which is defined by the cumulative capital increase, under estimation of long-term growth rate of a monetary stream [1].

A.Damodaran has investigated the influence of financial leverage on value of the company taking into account the risk of bankruptcy connected with the size of duty covering factor [4]. The basic conclusion is the following: there is an optimum size of loan capital under which the capital value estimate is maximal.

The scenario concept of the company development estimation in management is developed by R.Brejli and S.Myers [3]. Within the framework of the concept at the first stage of estimation the manager defines a basic variant of company development and estimates the principal value. Further, the alternative company development variants or scenario are investigated, in which some model parameters are changed simultaneously. Thus, there is a potential value deviation from the basic level which is possible to estimate under different assumptions about the company development.

Other approaches are based on generalization of conclusions received by tools of financial and economic analysis of company's activity. In general such approaches contain the recommendations on the company work improvement, which have positive impact on the value [2, 6]. However this approaches does not reveal the connection between the offered recommendations and the basic value analysis tools.

Thus, the modern practices of the company value managing consist of the following techniques:

1. The company value modeling by detailed elaboration of the Gordon's model parameters.
2. The analysis of internal and external circumstances of the company.
3. Development of the variants or scenarios of the company development.
4. Estimating the company value according to the different variants of development.
5. Defining the key value factors by the elasticity parameters analysis, and analyses

of possible volatility of the separate model parameters.

6. Acceptance of administrative decisions being focused on increase of company value, and also on its stability to possible fluctuations of separate model parameters.

The basic accent in presented work is made on the business value factors analysis with using of the value elasticity coefficients to major factors of manufacture. The authors have attempted to adapt the elasticity analysis approach to investigate factors of value of enterprise processing complex raw materials.

The object of the research is Achinsk alumina combine (AGC) located in the Krasnoyarsk region and processing the nepheline ore to produce an alumina and other different products: soda ash, potassium sulfate, potash and cement. The supplier of the nepheline ore on the alumina combine is the Kiya-Shaltirsky deposit located in the Kemerovo area. The urgency of research is caused by a gradual exhaustion of stocks of Kiya-Shaltirsky deposit [12]. Ores of AGC's reserve deposits (Gorjachegorskoe, Tulujulskoe, Andriushkina rechka, etc.) are characterized by the considerably worse chemical compound, which demand additional expenses for beneficiation of ore [11]. The problem of involving into processing less qualitative nepheline ores still remains unsolved for the Russian aluminum industry. Complex processing of natural resources will be preferable in long term, as stocks of high-quality raw material in the world are limited and tend to deplete.

Traditional techniques of estimation of the raw material processing technologies basically use the output parameters, cost prices, and poorly count market factors. The other existing techniques based on cost price analysis within the correlation and regression methods meet the certain technical estimating problems in view of the insignificant variation range of technological

parameters and also does not consider impact of market factors. To estimate the efficiency of the interconnected multinomenclature manufacture is demanded to develop the approach considering a number of other factors including risks. Using the enterprise value as the general efficiency indicator allows considering following significant factors:

1. Market prices for products and basic industrial resources.
2. Specific technological parameters.
3. A possible deviation between the realized product and manufactured product, which reflects influence of demand fluctuation.
4. The risks connected with structure of realization.
5. Demanded profitableness of the capital.

Key advantage of the enterprise value estimation as the efficiency parameter is the opportunity to investigate the offered technological decisions to concrete conditions of enterprise functioning.

The purpose of this article is to define the key value factors by developing the value model and estimating value of the enterprise processing complex raw material and manufacturing a wide assortment of products. It supposed to study the business value sensitivity to technological and market factors.

Description of the baseness value estimation model

Under processing the Kiya-Shaltirsky nepheline ores the AGC produces the following basic products: alumina, soda ash, potassium sulfate, potash and cement. The generalized technological scheme of complex processing of the nepheline ores is shown on Fig. 1.

Let's note following features of considered technology:

1. Presence of the general complex industrial expenses connected with extraction, enrichment,

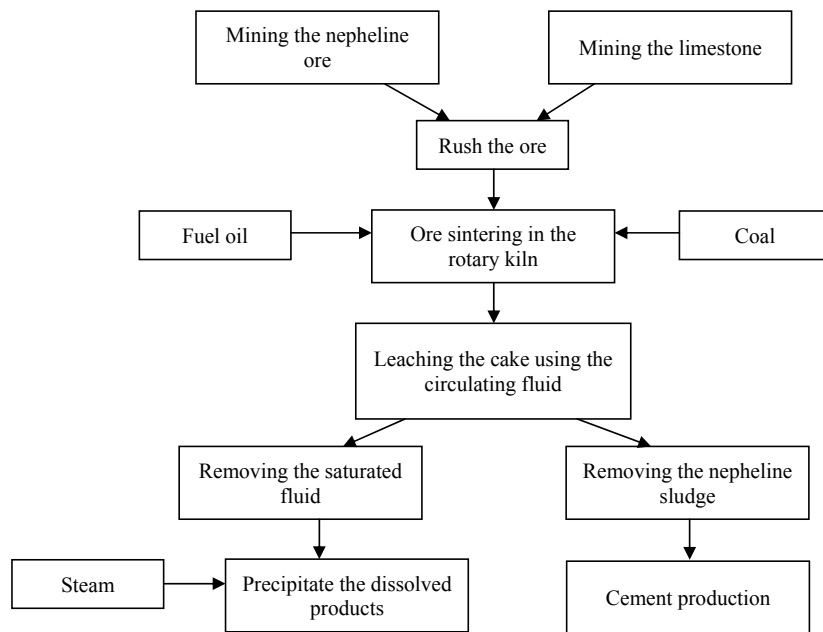


Fig. 1. The complex technology of nepheline processing (Based on materials [7])

transportation and sintering of ore, which cannot be divided unequivocally between outputs of products. Complex expenses can have a significant share in the cost price for production. For example, the share of such expenses for Achinsk alumina combine may be about 60 percent.

2. Following feature is limitation of opportunities to change the products outputs nomenclature. The complex technology of ore processing assumes consecutive extraction of products under the scheme: nepheline sludge – alumina – soda ash – potassium sulfate – soda ash – potash. The soda ash is extracted in two steps.

3. The third feature of complex processing of the nepheline ores is the interconnected output. It means that the increase in the output of one product is probably only under expansion of production of other products. Therefore, the possible problem of the complex enterprise may be the accumulation of non-realized products. The significant decrease in market demand on the same manufactured products of complex

enterprises can lead to significant decrease in revenue position. Parameters of production output on one ton of consumed working mixture (a crushed ore mix for sintering) are demonstrated in Table 1. The production output is a key technological parameter of enterprise processing the complex raw materials; it shows possible volume of each product manufactured on one unit of consumed raw material. The different variants of drawing up of the ore mix and the production output corresponding to mix are shown in Table 1 for comparison: with nepheline and with a bauxites addition. The nepheline processing technology with the bauxites additive is studied by S.Vinogradov [8]; details of this scientific work are not the subject of our research. In this paper we consider the bauxite additive as the alternative variant of nepheline ores processing. The main feature of this production variant is multidirectional economic effects: increasing the alumina output while the production of accompanying products (soda ash and potash) is reducing.

Table 1. Product's yield per ton of mix*

Yield	Current production	With bauxite addition		
		10 %	20 %	30 %
Alumina, kg/t	66,7	72	78	83,4
Soda ash, kg/t	37,1	24,5	13,7	5,2
Potash, kg/t	1,2	0,8	0,44	0,17
Potassium sulfate, kg/t	2,2	2,2	2,2	2,2

* Calculated with data from [8]

4. The fourth feature of complex technology is ambiguity of an efficiency estimation of separate manufactures. In our opinion, using the business value estimation as the efficiency indicator allows to avoid problems with cost prices calculating. In case of complex processing there is no reliable criterion of separating the general industrial expenses, therefore the estimation of the cost price for manufactured output in many respects will depend on the selected method of distribution of technological and other general expenses. Also the business value is a preferable efficiency indicator for capital owners. The business value model allows analyzing the capital value increment because of the market changing (external parameters) and production structure (internal parameters).

In our paper we use the Gordon's capitalization model as the fundamental instrument of the business value estimation. This model is shown in formula (1). The Gordon's model can be much closer to the market capital value provided the investors are inclined to make decisions analyzing the possible cash flows.

$$PV = \frac{CF_0 \cdot (1 + q)}{r - q}, \quad (1)$$

where PV is estimate of the present value of the own company's capital;

CF_0 is the forecasting operating cash flow;

q is the long-term growth rate of cash flow;

r is the required rate of return on the own capital.

We offer to use the business value models as the instrument of comparing the internal plans of company's development. Also these models are theoretically justified and allow avoiding the equivocation in their treatment. Below we are detailing the parameters of cash flow (CF_0) taking into consideration formulated features of complex processing.

The main distinction of complex processing is in the structure of cost-price. There are several groups of expenses:

1. Technological costs. This group includes expenses on extraction, enrichment, transportation, sintering the nepheline ores and obtaining the products. In complex processing the nepheline technological costs are connected with the production of the key product – alumina. So the alumina production determines the volume of consumed mixture that is connected with specific technological parameters and market prices for corresponding industrial resources. Formula (2) demonstrates the cumulative technological expenses:

$$IC = Q_{al} \cdot SC_b \cdot (SC_f \cdot P_f + L + C + SC_e \cdot P_e + SC_h \cdot P_h), \quad (2)$$

where IC is general technological complex costs;

Q_{al} is the expected realization volume of alumina;

SC_b is specific consumption of mix per ton of alumina;

SC_f is specific consumption of fuel per ton of mix;

SC_e is specific consumption of electricity per ton of mix;

SC_h is specific consumption of heat energy per ton of mix;

L is specific costs of the ore transportation;

C is specific costs of the ore concentration;

P_f is the market price for fuel;

P_e is the market price for electricity;

P_h is the market price for heat energy.

2. Overhead costs. This group of expenses includes:

1) payment for labor and deductions to extra-budgetary funds;

2) repair and maintenance of the fixed assets;

3) amortization;

4) taxes including in the cost price;

5) costs of the nepheline sludge storing;

6) costs of storing the unrealized products;

7) heat energy and electricity costs on the production facility;

8) costs of supplying the production labour with the working clothes and special implements;

9) payment of rent;

10) other costs.

These expenses can be classified on variable and constant. In the business value model we assume that the variable expenses depend on the volume of production directly or indirectly. We assume that expenses for a payment change are proportional to the labour-output ratio and volume of production. Expenses for supplying the production labour with the working clothes and special implements vary directly to a number of the working personnel. Expenses for storage of non-realized production depend on a difference between volume of produced and realized

products, and also from specific expenses for warehousing a unit of products.

Other overhead costs have a conditional-constant character and do not depend on the volume of production. In our business value model we assume that these costs are not changing because the scale of production remains constant. Expenses for the nepheline sludge storage have the capital character connected with necessity of construction sludge storage in process of accumulation of waste. Formula (3) result definition of the overhead costs:

$$OC = \sum_{i=1}^n V_i \cdot l_i \cdot P_s \cdot (1 + t_f) + \sum_{i=1}^n (V_i - Q_i) \cdot R_i + R_{ns} + A + VC + PC, \quad (3)$$

where OC is the total overhead costs;

V_i is the volume of production of the i -st product;

Q_i is the volume of realization of the i -st product;

l_i is the labour-output ratio of the i -st product;

P_s is the average annual wage of labour;

t_f is the rate of payments to the extra-budgetary funds;

R_i is the specific costs on storing the i -st product;

R_{ns} is the specific costs on storing the nepheline sludge;

A is the amortization of the capital assets;

VC is the other total variable overhead costs;

PC is the other total constant overhead costs.

3. Management and commercial costs. Management costs have a constant component basically connected with a service of an administrative house; the variable part depends on a number of the administrative personnel,

which is connected with a quantity of workers of the basic manufacture. Commercial expenses are variable and depend on the volume of shipped production.

4. Costs of the independent production. Some products require further processing within the framework of the independent production. For example, the nepheline sludge are passing into the cement production, which supposes the second roasting the sludge with additional materials.

The structure of revenue doesn't need the separate classification. The revenue is the result of multiplying the volume of sold products on their market prices.

In our business value model we assume that the reserve of basic technological materials is being paid by suppliers. So the difference between the cash flow and net profit is in the volume of the amortization. Thus, in formula 4 the detailed Gordon's business value model that can be used for estimating the technological efficiency of complex processing the nepheline ores is shown.

$$PV = \frac{(\sum_{i=1}^n Q_i \cdot P_i - \sum_{i=1}^n V_i \cdot DC_i - IC - OC - MC - CC) \cdot (1 - t_N) + A}{r - q} \cdot (1 + q), \quad (4)$$

where PV is the estimating current value of own capital of the complex production company;
 P_i is the market price for the i -st product;
 DC_i is the direct costs on producing the i -st product;
 MC is the managing costs;
 CC is the commercial costs;
 t_N is the income tax rate.

Estimation of value elasticity to factors

Formulated mathematical model allows providing a factor analysis using the impact quantities – the elasticity coefficients. This

approach gives the quantitative estimation of external and internal factors influencing on the business value for comparing development plans. The elasticity coefficients illustrate the possible increment of the efficiency indicator (the business value estimation) after changing one of the model parameters on 1 %.

Using the formula 5 the elasticity coefficients can be constructed.

$$\gamma_\phi = \frac{\delta PV}{\delta \phi} \cdot \frac{\phi}{PV}, \quad (5)$$

where γ_F is the elasticity coefficient of the business value by the parameter F ;
 $\frac{\delta PV}{\delta \phi}$ is the partial derivative of the business value model.

The derived elasticity coefficients formulas are demonstrated in Table 2. The alternative variant of calculating the elasticity coefficients is making the mathematical model with using the special computer programs (for example, MS Excel).

The main problem of the business value estimation is the absence of the correct information for calculating the cash flow. The annual financial report contains the information about the commercial result that differs considerably from the existing production result; in other words, the gap between production and financial cycles makes the barriers of using capitalization value models. Formulated formulas (1) – (4) make it possible to give the estimation of the normal cash flow matched with the expected producing volume. In Table 3 we give the estimation of the ACG cash flow for different processing variants listed in Table 1. In this paper we consider that it's correct to view only the methodological aspect of the formulated ACG problem because the technological aspect is not investigated enough in the existing scientific literature. Using the joint sintering processing with the bauxite addition as the alternative producing variant makes it easier to

Table 2. The elasticity coefficients of the business value*

Elasticity factors	Formula
- selling price	$\gamma_{P_i} = \frac{P_i \cdot Q_i \cdot (1 - t_N)}{CF_0}$
- volume of production	$\gamma_{Q_i} = \frac{(P_i - DC_i - IC_i - VC_i - CC_i - MC_i) \cdot Q_i \cdot (1 - t_N)}{CF_0}$
- specific consumption of mix	$\gamma_{SC_m} = -\frac{IC \cdot (1 - t_N)}{CF_0}$
- specific technological indicators	$\gamma_{SC_j} = -\frac{Q_{rn} \cdot SC_m \cdot SC_j \cdot P_j \cdot (1 - t_N)}{SC_0}$
- specific storage costs	$\gamma_{R_i} = -\frac{\sum_{i=1}^n (V_i - Q_i) \cdot R_i \cdot (1 - t_N)}{SC_0}$
- specific costs on building the sludge warehouse	$\gamma_{R_{hnn}} = -\frac{R_{hnn} \cdot (1 - t_N)}{SC_0}$
- laboriousness of production	$\gamma_{l_i} = -\frac{\sum_{i=1}^n V_i \cdot l_i \cdot P_s \cdot (1 + t_f) \cdot (1 - t_N)}{SC_0}$
- increase rate of the cash flow	$\gamma_q = \frac{CF_0 \cdot (1 + r)}{(r - q)^2}$
- required rate of return on the own capital	$\gamma_r = -\frac{CF_0 \cdot (1 + q)}{(r - q)^2}$

* Author's derivations

understand the mechanism of using the business value models in estimating the technological efficiency.

Using the formulas in Table 2 and company's economic indicators in Table 3 it's possible to calculate the elasticity coefficients as in the example given below:

Table 4 shows the results of calculating the elasticity coefficients divided on two groups: technological and market. The market factors are external and they are forming the environment determining the technological efficiency. Managers have limited levers of the influence on the market environment.

Calculated elasticity coefficients allow providing the factor analysis of different production variants. The factor analysis gives the information about company's market

stability and key technological factors with their influence on the business value. The managers of AGC may use the viewed approach for determining the permissible deviation of key technological factors within the framework of the problem of choosing the optimal processing variant. Some conclusions of our paper are shown below:

1. Viewed production variants have the similar business value but concentrating the production is increasing the impact of the alumina price as the key market factor.

2. The key technological factors are the next: the alumina yield, the specific blend consumption, the soda ash yield, the specific fuel and electricity consumption. For example, increasing the specific blend consumption on 10 % (as the result of decreasing the raw materials quality) will lead

Table 3. Expected cash flows of ACG*

Indicators	Current technology	Variants of the bauxite addition		
		10 %	20 %	30 %
The volume of sales:				
-alumina, ths tn.	1069,4	1155	1251,2	1336,8
-soda ash, ths tn.	595,1	392,8	220,2	83,3
-potassium sulfate, ths tn.	35,3	35,3	35,3	35,3
-potash, ths tn.	19,2	12,7	7,1	2,7
-cement, ths tn.	1400	1400	1400	1400
The revenue, m. rubles	24222	23685	23547	23565
-alumina, ths tn.	14700	15876	17199	18375
-soda ash, ths tn.	4941	3261	1828	692
-potassium sulfate, ths tn.	565	565	565	565
-potash, ths tn.	96	64	36	13
-cement, ths tn.	3920	3920	3920	3920
Cumulative costs, m. rubles	17120	16915	16778	16685
-technological costs, m. rubles	11451	11311	11218	11154
-overhead costs, m. rubles	4479	4414	4370	4341
-independent costs, m. rubles	1190	1190	1190	1190
Commercial costs, m. rubles	1211	1184	1177	1178
Management costs, m. rubles	1410	1334	1284	1250
Profit on sales, m. rubles	4480	4251	4307	4451
Tax on profit, m. rubles	896	850	861	890
Net profit, m. rubles	3584	3401	3446	3561
Amortization, m. rubles	950	950	950	950
Cash flow, m. rubles	4534	4351	4396	4511
Variation of the business value, %	-	-4,04	-3,05	-0,52

* Author's derivations with using materials [12, 13]

to losing the business value (as the cumulative production efficiency) more than 20 %.

3. Increasing the level of the bauxite addition leads to concentrated production of the alumina. In comparison with the current technology these production variants have the similar influence of varying the specific consumption of technological resources; but the development of accompanying products is losing the previous power.

4. To the side of market prices AGC has some safety margin. For example, increasing the

price for coal on 10 % leads to losing the business value no more than 4 %. But such deviation on the alumina market can be dangerous for the AGC financial stability.

5. In our opinion, the remainder of the unrealized products doesn't lead to huge losing the business efficiency even if decreasing the market demand is about 30 %. In this way, the business value is decreasing only by 10 %.

In conclusion it is necessary to note that business value models discover their application

Table 4. The elasticity coefficients*

Elasticity coefficients	Current production	With bauxite additive		
		10 %	20 %	30 %
Technological factors				
-specific consumption of the fuel oil	-0,48	-0,5	-0,49	-0,48
-specific consumption of the coal	-0,36	-0,38	-0,37	-0,36
-specific consumption of the electricity	-0,13	-0,12	-0,12	-0,11
-specific consumption of the heat	-0,22	-0,21	-0,2	-0,18
-yield of the alumina	2,13	2,29	2,45	2,56
-yield of the soda ash	0,64	0,41	0,22	0,08
-yield of the potassium sulfate	0,08	0,08	0,08	0,08
-yield of the potash	0,01	0,01	0,003	0,001
-laboriousness of processing the fluid	-0,35	-0,34	-0,31	-0,3
-laboriousness of processing the nepheline sludge	-0,12	-0,12	-0,12	-0,12
-specific consumption of the blend	-2,02	-2,08	-2,04	-1,98
-output of the cement production	0,17	0,34	0,34	0,33
Market factors				
-price for alumina	2,6	2,77	2,97	3,1
-price for the soda ash	0,83	0,57	0,32	0,12
-price for the potassium sulfate	0,09	0,1	0,1	0,1
-price for potash	0,02	0,01	0,01	0,002
-price for cement	0,66	0,68	0,68	0,66
-volume of sales of the alumina	2,55	2,88	3,09	3,22
-volume of sales of the soda ash	0,88	0,61	0,34	0,12
-volume of sales of the potassium sulfate	0,1	0,1	0,1	0,1
-volume of sales of the potash	0,02	0,01	0,01	0,003
-volume of sales of the cement	0,78	0,81	0,81	0,79
-distance of the transportation	-0,73	-0,76	-0,75	-0,73
-price for the fuel oil	-0,48	-0,5	-0,49	-0,48
-price for coal	-0,36	-0,38	-0,37	-0,36
-cost of ore mining and processing	-0,11	-0,11	-0,11	-0,11
-cost of the electricity	-0,39	-0,4	-0,39	-0,37
-wage	-0,22	-0,21	-0,2	-0,19
-remainder of the unrealized products	-0,27	-0,28	-0,27	-0,25

* Author's calculations

not only in the financial relations on share markets; they can be used also in decision making within the internal environment of the company, such as estimating the technological efficiency and choosing the plan of further development. The business value is a good cumulative indicator of the company efficiency; each business model is theoretically justified and assumes the balanced

set of external and internal factors. In our opinion, the AGC raw materials providing problem requires developing the adapted estimating approaches to the features of complex processing. The provided calculations show the opportunity to apply the elasticity coefficients to determining the permissible limits of the specific technological indicators deviation.

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**Оценка эластичности стоимости бизнеса
как инструмент анализа факторов
развития предприятия
(на примере Ачинского
глиноземного комбината)**

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Методы оценки стоимости бизнеса нашли широкое применение в современном менеджменте организаций. Основной акцент в представленной статье сделан на анализе факторов стоимости бизнеса с использованием коэффициентов эластичности стоимости. Авторы попытались адаптировать подход анализа эластичности к исследованию факторов стоимости предприятия, занимающегося переработкой комплексного сырья. Модель стоимости бизнеса адаптирована к производству, основанному на комплексных технологиях переработки нефелиновой руды. Были выведены и оценены технологические и рыночные коэффициенты эластичности стоимости для Ачинского глиноземного комбината.

Ключевые слова: оценка стоимости бизнеса, модель Гордона, коэффициенты эластичности, комплексное сырьё, Ачинский глинозёмный комбинат.
