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MODELING OF INVESTMENT ATTRACTIVENESS OF ENERGY ENTERPRISES OF UKRAINE UNDER GLOBALIZATION (COAL INDUSTRY CASE STUDY)

A strive of the coal-mining enterprises for investment is their priority objective under conditions of economic crisis. Innovative development of the enterprises is primarily attained through upgrading their mining assets, operation technology and raising safety standards. The implementation of clean coal technologies, coal extraction and enrichment requires a significant investment in the geological and marketing research, and studies of the technical, technological and economic conditions. Formation of appropriate investment strategy requires finding sources of business finance; therefore the creation of the two areas of investment at the level of industry and enterprise in the framework of the strategy is of particular importance.

The Strategy of the Coal Industry Development to 2030 indicates the state to be a major investor in the coal industry for the next 20 years. However, the Strategy envisages the reduction of funding for their businesses and access to self-sufficiency of production. The application of the clean coal technologies of extraction and enrichment is a key development strategy of coal enterprises through simulation of innovations, which makes up the research topic worthy.

This study is based on the contributions made by a number of researchers into exploration of the issues related to funding innovative development of the coal-mining enterprises: A. Alymov, A. Amosha [2, p. 3], A. Akmayev [1, p. 129], A. Astakhov, O. Wagons, D. Halushko, T. Hatova, G. Provinces, F. Evdokimov, M. Ivanov, A. Kabanov, I. Pavlenko, I. Petenko [5, p. 255], B. Reichel, V. Sally [6, p. 22]. However, we attempt to use modeling of the industrial development in order to focus on the core unsolved problems of ensuring investment policy of implementing the clean coal technologies and raising capacity of coal mining assets. Besides, there is a need to study the concept of evaluating the status of each coal mine.

The purpose of the study is modeling the process of investing in the innovative development of the coal industry. The framework of the study purpose involve a necessity to solve such problems as the analysis of the current forms of reproduction industry, identifying key problems and inefficient use of funds to construct a model of evaluation of investment attractiveness of mines including sectoral priorities and trends on the

world coal market in the context of sustainable development.

Mining industry as a set of individual enterprises has a structure`s ability, because new construction and reconstruction (modernization) are elements in different directions; closure of some mines is also of this structure elements. Its formation depends on the relation between coal-mining enterprises at some period of time at which carried out various forms of reproduction industry (simple, extended, narrowed). According to some form of reproduction separate enterprises and industry, based on a systematic approach, have identifying an appropriate funding sources: a simple reproduction of a separate enterprise is obliged to finance the enterprise itself and extended – an industry that can attract investment funds from different sources. In this case the volume of industry investments is not the sum of individual enterprises investments under these conditions Investments provided mainly "on demand", when there is a need for in the process of development of mine, construction or reconstruction of the separate elements of technological lines or buying equipment. All these possible sources of concerning enterprise and industry has its own advantages and disadvantages and a focus that is desirable to increase or decrease the share of appropriate sources (Table 1).

Table 1
Desired funding coal mining enterprises *

Source of investment	Desired focus share of investment		
	for individual enterprise	*for the industry*	for the state budget
State budget funds	*increasing*	*increasing*	*reduction*
Own funds	*reduction*	*increasing*	*increasing*
Bank Loans	*reduction*	*reduction*	*reduction*
Borrowed funds	*reduction*	*reduction*	*increasing*

* Developed by author based on data [3, p. 29].

The dynamics of coal industry financing structure by source in accordance with "The Strategy" provides a temporary increase of the state budget share from 72.6% in 2007 to 77.5% in 2011, would be followed by

a gradual decline to 67.0% in 2030 , reducing the share of own funds of enterprises from 27.2% in 2007 to 14.7% in 2030 and increasing the share of other private sources from 1.0% in 2007 to 18.4% in 2030. Thus the average annual volumes of financing are increasing by the state budget from 2.25 billion in 2007 to 4.51 billion in 2014.

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We are conducting a systematic analysis of objects related to the conservation capacity potential of mines by the degree of development of average annual estimated cost (Table 2). The study includes 91 object, including new construction, reconstruction and technical re-equipment of the Capacity Expansion - 34 and reconstruction and technical requipment without the capacity expansion - 57 objects. Assets under construction are 855 because of insufficient of capital investment, which it is used to construct a total of 5.01 billion. capital investments. Continuous under-funding of capital construction (volume decreased by 3.8 times - from 870 million. In 1991 to 229.4 million. In 2013) has caused a sharp reduction in construction works, including carry out preparatory workings decreased from 2232.7 km in 1990 to 639.2 km in 2013.

Table 2

Development of cost estimate limit by groups objects from 2008-2013*

Indicators	Data unit	Index by groups of objects					Total
		new construction	reconstruction increment of of capacity	reconstruction without the capacity expansion	technical retooling with an increase of capacity	technical retooling without the capacity expansion	
The number of objects	object	7	18	20	9	37	91
Started work by groups of objects	–	1965	1984	1979	1982	1979	-
The estimated cost of construction	mln. UAH	2702	5961	3559	1106	3789	17117
The average estimates cost of object	mln. UAH	386	331	178	121	102	188
Disbursed cost estimate limit of 01.01.2008	mln. UAH	1516	1421	1655	541	1726	6559
Disbursed cost estimate limit of 01.01.2013	%	56,1	23,8	46,5	48,9	45,6	40,0
The distribution of objects at the average annual percentage of estimated cost for disbursedcost estimate limit of 01.01.2013							
less than 1,00	object /% disbursed	–	6 / 11,9	8 / 10,9	–	2 / 7,5	9 / 11,5
1,01 – 2,00	- // -	2 / 53,3	3 / 18,7	8 / 38,8	–	4 / 18,6	17 / 36,0
2,01 – 3,00	- // -	1 / 50,8	3 / 38,8	3 / 51,5	5 / 44,3	5 / 51,8	17 / 47,1
3,01 – 5,00	- // -	3 / 70,5	4 / 56,8	3 / 47,6	1 / 73,5	9 / 71,8	20 / 63,9
5,01 – 10,00	- // -	–	1 / 48,1	5 / 9,2	1 / 100,0	9 / 67,8	16 / 66,1
more 10,0	- // -	1 /100,0	1 / 58,6	–	2 / 35,3	8 / 59,4	12 / 54,8
The average annual estimated cost disbursedcost estimate limit by groups objects	%	1,40	1,19	1,86	2,22	1,82	–

* Developed by author based on data [7, c. 24-83].

All objects will divide into the following groups (in percent per year): from development to 1.00; 1,01-2,00; 2,01-3,00; 3,01-5,00; 5,01-10,00; more than 10.00 per year. The calculation results are shown in Table. 2.

Work on the preparation and disclosure of excavation or field training layers and layers of support or capacity increase mine that it is work, caused by the development of mines in the space are characteristic of most of the point out groups (particularly the first four). Out of the total estimated cost of the object (17.117 billion.) only 57% (9,769 million.) accounts for elements intensive development industry (new construction, reconstruction and technical re-equipment of power increase). Thus, almost half of the volume of financing from state budget accounts for support of capacity of existing enterprises, that is a simple reproduction.

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Determined that in real conditions when it is desirable to facilitate intensity of the state budget and increase the share of own funds, the role of loans can be increased, especially under favorable credit terms (low bank rate). It is obvious, that terms of construction is so stretched unacceptable, particularly, when you consider the work of minefield. Based on the above, it can be concluded, that the investment policy, carried out for a long time, was unsatisfactory, because it has the following principal errors:

- mainly funding of facilities the simple (extensive) reproduction in loss extended objects (intensive) development;

- distribution of unsatisfactory by volume funding between numerous objects;

- focus on the prolonged timing of planned of work on individual objectst, that it generates large volumes of work in progress.

The long periods of construction is not objectively necessary. They are subjective because they arise due to the managing investments process, but when we detailed study of issue – it is not, although volume of financing is really insufficient. Whatever volume of financing, including insufficient, there is another aspect of the issue - use of it that is. As the possibility of "less need", then the easiest method of apportionment – give all of equally and gradually, as happens in reality. Is much more difficult to make allocation on the principle of most efficient use of available resourcesthat it is targeted. For this purpose, in particular, is necessary quantify the "state of mine" and determine what to expect from this mine, if it provides the particular funding.

There is a need to develop scientifically based of methodological approach to determining the investment attractiveness of coal mines influenced by pre-defined the system of environmental and industrial factors. That economic subsystem mine is determined interaction of the other two subsystems: the extraction of mineral resources and the preparation of new reserves to further working out.

Adapting the methodology of quantitative assessment of the investment attractiveness of the choice to build a favorable investment objects. The difficulty lies in the fact that certain factors that describe the state mine directly to not comparable with each other, such as the depth of mining of coal and the kinds of coal. Accounting for the effects all existing factors is rather complicated, therefore is required choose from the main of them that really shape the extent investment attractiveness of mine. It is advisable to determine investment attractiveness of the mine as a quantitative index of the state, which preliminary (without the project) describes as feasibility maintain or increase the capacity of the enterprise, with a larger value of the index corresponds to a higher degree of relevance. Investment attractiveness of mine is characterized geological base and the level of development of industrial factors, and hence the attractiveness index should take into account both of these factors. The quantitative influence major environmental and of industrial factors on investment attractiveness mine is shown in Table. 3.

The study suggests, index of investment attractiveness (I) of the mine as a whole to determine as composition of these nine factors, with the value I have a level of 0.6 ... 3.3. In particular, for mine "Komsomolets Donbas" industrial factors provided at the level of 2.4, and environmental - 0.6. The smaller value of this index corresponds to less investment attractiveness, that is reconstruction and maintenance of such mines requires more capital investments (to bring these mines to the level of large, efficient operating companies).

This approach makes it possible to rank mine according to their investment attractiveness and opens the possibility of an objective and substantially to approach to solving the issue about whom or advisable

preferable to send investment, the total of which is always limited.

The complex of natural and industrial factors that determine the level of investment attractiveness of mines *

Environmental factors	Industrial factors
The residual mineral reserves	Throughput the main units (production processes) of mine
Capacity coal seams being developed	The complexity of underground of mine management
Immutability seams within the limits a mine field	The production capacity of the mine
The depth of mining of coal	The average volume of annual production for several years
The kinds of coal	

* Developed by the author based on data [4. with. 4-11].

Determination of the index of investment attractiveness provides an opportunity to make a a comparative assessment of the state mines, but then is necessary with the mine aggregate got with higher index of investment attractiveness to choose the specific mine which should to send resources of capital investments. Established that of nine factors that describing investment attractiveness mine is most closely related with the capital investment capacity are capacity seems and throughput the main parts of the enterprise. The larger capacity and less through put varies some basic parts of the mine, the less need for capital investment to support or increase the capacity of mine.

At the same capital investments in these coal mines you can obtain greater effect. It is therefore logical to consider these mines a perspective and invest is primarily in such enterprises. Based on these common prerequisites, it is advisable to use a quantitative index of perspective mines that enables determine the sequence of of capital investments by some enterprises under limited of investment opportunities in the industry.

We analyzing the group of mines in one region or some mines from different regions in a mode of comparison of, we obtain a list of mines that have different levels of technical, economic and financial indicators. As a result, these mines have different investment attractiveness, and the task is put on targeting and a priority for investments. We suggest a mechanism of comprehensive assessment of investment attractiveness and priority of mines.

First of all, we determine for each mine level of economic of reliability and attractiveness. These parameters are indicative of internal reserves of the mine in terms of favorable to invest, and on this basis we

divided the mine into 3 groups (leaders, middle and closing) with appropriate assessment on a five point scale. Each score is the aggregate estimation of indexes the mine (combined coefficient of, the level of investment attractiveness). The higher the score, the greater the probability of transition to another group of the enterprise, and subsequently larger size of investment.

The next stage of research is to construct a model identifying perspective mines. As the objective function is adopted the maximum of coefficients of perspective mine:

$$A = \sum_{i=1}^{n} G_i \Rightarrow \max , \qquad (1)$$

limitations:

$$\sum_{i=1}^{n} k_i \leq K ; \quad \sum_{i=1}^{n} D_i \geq D_0 ; \quad n = \frac{1.5 \, K}{q} \geq 10 ;$$

$$G_i = mq_i \times tq_i . \qquad (2)$$

Conventional signs in models (1) - (2):

A – the objective function; K – the annual volume of capital investments allocated for the reconstruction of the mine again; q – the average annual resource development capital investments in once again reconstructed the mine; n – amount of the mines that can be reconstructed according to available investments; 1.5 – reserve ratio of the considered mine (in order to prove amount them of not less than 10); q_i – the index of the mine under consideration, $i = \overline{1, n}$; mq_i – mqi - capacity of seams on *i-mine* (relative indicator); $i = \overline{1, n'}$; tq_i – technological reliability coefficient *i-mine* $i = \overline{1, n'}$; G_i – coefficient of perspective *i-mine* $i = \overline{1, n'}$; k_i – amount of capital capacity (annual) for *i-mine*; D_i – mining in the *i-mine* $i = \overline{1, n'}$; D_0 – specified or desired production levels.

This index for groups of Dobropilskiy mine is 4, but for mine Torez-Snizhne region this index is 2. The combination of mine with the largest values of the index of perspective with further targeted prospects investment is determined by the number of perspective of mines.

Suggested model is adapted to the conditions of partial reduction potential of enterprises concerning mining of anthracite in terms of transformation is relatively to perspective the mine to infrastructure of Torez region under the criterion rising living standards. It is established that the level of investment of 400 million. and the availability of funds in the amount of 50 UAH. on 1 ton capacity the mine "Progress" is capable by 2015 to increase production volumes of high quality coal to 1.1 million tons per year in of labor productivity 41 tons per month. The mine would have been self-sufficient enterprise and it has reached a level of profit

that is larger before tax in 2015 amounted to about 35 million UAH over a five year period.

Therefore, identification of the index of investment attractiveness provides an opportunity to make a comparative estimation of the state mines and making use of the aggregate of the mines having the highest indices of investment attractiveness to choose the group of specific mines, which deserve allocation of the larges resources of capital investments. The coal seams and capacity of the main parts of the mines are shown to be the most closely associated with the capital investment capacity of the nine factors that characterize the investment attractiveness of the mine. The more the capacity of the coal seams and less varies of the capacity of some basic parts of the mine, the less capital investment is required to maintain or increase the mine capacity.

To attract loans of international banks it is required to disclosure the patterns in volatility of the mine prospective values, which are of paramount importance while forming the regional budget, and also creation of an anti-crisis program of coal regions development. Social and environmental aspects of coal regions require further investigation in the context of globalization to create programs that support the miners, subject to early retirement and projects that support areas of abandoned mines and provide their sustainability, greening processes in the mines and use of the clean coal technologies in mining and enrichment of coal. Adaptation of international experience in creating and implementation of these programs will have a positive effect not only on investment of the region, but also on the increase of the overall innovative activity.

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Павленко I. I. Моделювання інвестиційної привабливості підприємств енергетичного комплексу України в умовах глобалізації (вуглевидобувний комплекс)

В статі виявлено причини провалу інвестиційної політики на вуглевидобувних підприємствах. Дослідження показує, що інвестиції в основному спрямовані на екстенсивне відтворення підприємств, що є досить тривалим у часі.

Запропонована методика дозволяє оцінити інвестиційну привабливість вуглевидобувних підприємств та її основні взаємозв'язки промислових та природних факторів, які визначають пріоритетність об'єктів для інвестування в контексті стійкого розвитку вугільної промисловості.

Група природних та технологічних факторів визначають інвестиційну привабливість вугільних підприємств, які обрані та ґрунтуються на основі дослідження виробничих запасів шахти.

Кожен фактор оцінюється кількісно з використанням порівняних характеристик. Розроблено алгоритм для визначення взаємного впливу перерахованих факторів на рівень економічної надійності шахті.

Ключові слова: інноваційний розвиток, моделювання, державна підтримка, державне фінансування, вугільна промисловість, капітальні вкладення, адресне інвестування.

Павленко И. И. Моделирование инвестиционной привлекательности предприятий энергетического комплекса Украины в условиях глобализации (угледобывающий комплекс)

В статье выявлены причины провала инвестиционной политики на угольных предприятиях. Исследование показывает, что инвестиции в основном направлены на экстенсивное воспроизводство и что долго во времени.

Предложенная методика позволяет оценить инвестиционную привлекательность угледобывающих предприятий и ее основные взаимосвязи промышленных и природных факторов, которые определяют приоритетность объектов для инвестиций в контексте устойчивого развития угольной промышленности.

Группа природных и технологических факторов, определяющих инвестиционную привлекательность угольных шахт, которые выбраны и обоснованы на основе исследования производственных запасов шахты.

Каждый фактор оценивается количественно с использованием сравнительных характеристик. Разработан алгоритм для определения взаимного влияния вышеуказанных факторов на уровень экономической надежности_шахты.

Ключевые слова: инновационное развитие, моделирование, государственная поддержка, государственное финансирование, угольная промышленность, капитальные вложения, адресное инвестирование.

Pavlenko I. I. Modeling of Investment Attractiveness of Energy Enterprises of Ukraine under Globalization (Coal Industry Case Study)

The paper identifies causes of the failure of investment policy at coal-mining enterprises. The study shows that investment is mostly aimed at extensive reproduction and extension projects of time that requires immediate completion. The method suggested allows assessing investment attractiveness of coal-mining enterprises and it highlights a relationship of the industrial and environmental factors that determines a priority of objects for investment in the context of the coal industry sustainable development.

A group of natural and industrial factors which determine investment attractiveness of coal mines are selected and grounded on the basis of study of production elements of the mine.

Every factor is valued quantitatively with the use of comparative (model) characteristics. The algorithm to determine mutual influence of abovestated factors on the level of economic reliability of the mine is developed. As a result, groups of mines are formed using the grade system in order to ensure that the addressee will be chosen but in accordance with the level of investment attractiveness.

There are generalized ideas of coal sector future development as for lifetime of mines, quality of reserves, and information about new construction sites as well as expediency to reconstruct a part of mine stock, and necessity to close unpromising mines which worked out their qualitative recerves.

Keywords: innovation development, modeling, clean coal technology, government funding, coal industry, capital investments, address investment.