AKTUAR MOLIYA VA BUXGALTERIYA HISOBI ILMIY JURNALI

Vol. 5 Issue 02 | **pp.** 402-408 | **ISSN**: 2181-1865
Available online https://finance.tsue.uz/index.php/afa

DRAWBACKS IN OPTIMIZING THE IMPLEMENTATION OF INVESTMENT PROJECTS OF ENTERPRISES.

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Annotation: The reliability of justifying decisions in complex projects comes at a high price, as mistakes involve not only multimillion-dollar economic losses, but also large-scale social and environmental consequences. It is possible to ensure high reliability of design solutions on a system optimization basis. The key problem of project development is the choice of objective optimality criteria that synthesize heterogeneous factors.

Key words: investment projects, capital intensity, discount rate, investment, NPV, IRR.

Investment projects are a priority area of free enterprise and the engine of economic progress. Large investment projects are characterized by their multidisciplinary nature, long-term decisions made in conditions of limited information, high capital intensity, and increased risk of varying nature and structure.

The change of the macroeconomic system in the CIS and Eastern European countries required a change in the principles of optimization at the microeconomic level, including the project level. The previously widely used indicator of the economic efficiency of design solutions - "reduced costs" - has lost its significance, the "principle of bringing alternatives to equal production volume" has lost its relevance, and there is no place for the use of "closing costs". The scope of application of the largely abstract criterion "profit of the accounting year" has been limited. However, it should be noted that recommendations on the use of these indicators, derived from a centralized management system, are still found in publications, including educational and methodological ones.

Table 1.

Table 1. Influence of the optimality criterion on the choice of on-board content

Indicator	On-board maintenance, g/t					
	4,6	4,0	3,6	3,4	3,3	3,0
Gold reserves, kg	8775	9433	10127	10297	10366	10481
Net discounted income, USD	30,12	42,80	35,99	36,39	46,23	45,18

million						
Internal rate of return, %	26,52	26,77	27,5	28,36	27,29	26,7
Net profit, USD million	56,2	51,59	65,3	66,76	66,83	64,98

In market economies, the IRR indicator is often used as the main criterion for the optimality of projects, without taking into account their industry differences. This choice is motivated by the fact that NPV requires a subjective determination of the discount rate. According to the IRR criterion, projects are also selected with limited capital investments, based on the financial capabilities of the investor, which is acceptable in manufacturing industries that are not directly related to the use of natural resources.

However, in the conditions of subsurface use, arbitrary restriction of investments is unacceptable due to the natural component of the potential of mining enterprises. Such a restriction shifts the optimum and does not allow to reveal the maximum economic possibilities of the deposit. As a result, not only are the project's capabilities underestimated, but the field itself may be transferred to an off-balance sheet category.

In some recent publications, it is proposed to use the IRR criterion for the selection of mining and technological solutions. Following this recommendation, the project would have to be optimized according to two criteria at once: mining and technological solutions should be selected according to the IRR indicator, and solutions related to the completeness of reserves extraction should be selected according to the NPV indicator. The reason is that the IRR criterion leads to a reduction in part of the conditioned reserves and an overestimation of the optimal losses of minerals.

Table 1 shows that when switching from the IRR criterion to NPV, the on-board content decreases from 3.6 to 3.4 g/t. This ensures an increase in the conditioned gold reserves at the site by 281 kg.

The IRR indicator is inherently unsuitable for optimization, as it puts alternative options in unequal conditions. Expressing the maximum interest rate, this indicator assumes a different amount of interest payments for capital, whereas in reality capital has the same market price.

The mentioned properties of the criteria are the basis for the concept of optimization industrial assessment of ore deposits and mining projects in market conditions, which recommends using NPV as an optimization criterion and IRR as a limiting indicator. To prevent possible errors, the discount rate should be set at an acceptable cost of capital, taking into account the risk. To control NPV, it is advisable to calculate at two levels of the discount rate.

Table 2.

Table 2. The degree of identification of the geopotential of a gold deposit using various mining technologies and optimization methods

Technology, optimization method	Optimized parameters and indicators Stocks					
	Stocks	Annual productivity, million tons	Net discounted income, million USD	Identifying the geopotential, %		
	one, million tons	content, g/t	metal, tons			
1. Gross production, static optimization	21	7,1	71	1,9	32,4	59
2. Gross production, quasi-dynamic optimization	7,4	8,58	58	1,87	39	77
3. Gross production, dynamic optimization	7,9	8,33	50,2	1,12	41,5	70
4. Gross production with differentiation of conditions, dynamic optimization	8,6	7,66	50,2	1,95	49,4	98
5. Advanced mining of rich ores, dynamic optimization	10,9	7,18	60,6	1,106	40,2	90
6. Advanced mining of rich ores with differentiation of conditions, dynamic optimization	10,7	7,16	69,2	1,103	44	200

The industry-specific problem of optimizing mining projects is related to the uniqueness of each deposit and the depletion of reserves, which is not reflected in the basic provisions of microeconomics.

The principle of "conceptualism" is formulated in the theory of management. It means that the project implements the goals and values of the team that proposed the project concept. This principle is unacceptable in mining engineering precisely because of the uniqueness of the deposits. In these circumstances, the project concept cannot be brought in from the outside. It must be generated and optimized based on the individual characteristics of a given deposit.

In contrast to the principle of "conceptualism" in mining engineering, the principle of purposeful optimization is asserted. At the same time, the natural economic potential (geopotential) of the developed field serves as a guiding guideline.

The geopotential is expressed by the maximum possible effect (NPV) from the development of a deposit, taking into account the completeness and complexity of the use of its reserves at the current price level on the world market, the use of the most advanced mastered extraction and processing technologies adapted to the specifics of this deposit. The key condition for identifying the geopotential is the multivariance of the search in system optimization design, which consists in the joint (based on a single dynamic model of a variable structure) selection of the entire complex of main parameters and technological solutions.

As experience has shown, targeted system optimization design allows some fields, even those previously considered unprofitable, to be converted into economically attractive ones for investors. In the table.2, using the example of a typical deposit, the

results of identifying its geopotential are presented. With the gross processing of ores of average quality and static optimization of parameters (for profit without discounting), the geopotential of the deposit is revealed by only 48%.

Establishing the geopotential is necessary to select the vector of the project search. The second stage of design is the implementation of geopotential, i.e. the development of solutions and methods for its full use. The optimal field development project will be one that best matches the geopotential. This is the second guiding principle of purposeful design, the methods of which are being developed at the Institute of Physics and Mechanics of Rocks of the National Academy of Sciences of the Kyrgyz Republic.

The presentation of an investment project as a complex system allows us to identify three components of its potential (P):

P = P1 + P2 + P3, (1),

where P1 is the potential of the internal elements of the project, depending on the technical level of the solutions included in it.;

P2 is the potential for interaction of elements, determined by the degree of harmonization of project parameters and technologies.;

P3 is the potential for consistency, depending on the level of adaptation of the project, as an integrated system, to the external environment.

The applied design technologies are focused primarily on unlocking the first component of the potential, i.e. the technical equipment of the main parts of the project. Its other two components have not yet been the subject of detailed analysis and use in project practice, which is a reserve for further progress.

The most comprehensive indicator of the potential of projects in market conditions, as well as geopotential, is net discounted income - NPV. Based on the structure (1), the sources of the potential of complex projects should be sought in all three specified areas:

P = NV1 + NV2 + NV3. (2)

The presented three-level structure of the potential should not be perceived as an algebraic sum of NPV. In fact, the potential of the project as a complex system is not additive. Based on the analysis of existing methods, the requirements for the technology of targeted design, focused on the full use of the potential of projects, are formulated (Table 3).

Table 3.

Table 3. Necessary characteristics of the technology of targeted project optimization

Sign	Characteristic
Design concept	Targeted system optimization
A way to formalize a goal	Single-criteria with limitations
Accounting for external conditions	Direct introduction of associated costs and results
The structure of the model	Block variable structure
Performance	Dynamic

The solution method	Computer simulation
Optimizing project development	In the project management system
Auxiliary techniques of existing methods	Normative direct calculations, analytical methods; Local, block optimization; Model system; Multi-criteria optimization; Static formulation; Method of variants with smoothing

The main characteristic of targeted system optimization is to ensure the interdependence of system-forming parameters and solutions, which is achieved using a single project model of variable structure. The variable structure of the optimization model is provided by its restructuring at each iteration. At the same time, each time the model is brought to a new suboptimal level.

Integration of design into the project management system (see Table.3) involves optimization at all phases of project development, including conceptual design, development, implementation and completion.

Let us reveal the last thesis in more detail. Of all these phases of the project life cycle, the conceptual one should be considered the defining one. In accordance with the principles of system optimization design, the project concept is also subject to multivariate optimization, since the subsequent development of the project is carried out within the framework of the strategy already outlined by the concept (the principle of conceptualism).

The analysis of the development of projects in various industries revealed a strong disparity between costs and results by phases of the life cycle (Table 4).

The longest conceptual phase accounts for 7-10% of all costs. At the same time, there is a 30-40% risk of underutilization of the project's potential associated with this phase. In order to increase the effectiveness of this phase (and, ultimately, the entire project), it is proposed to separate it organizationally into a separate stage, including the examination and approval of the concept. Only an optimal concept can serve as the basis for technical and detailed design.

Table 4.

Table 4. The significance of the main phases of the investment project life cycle

Indicator	**Project phases, %**			
	concept	development	implementation	completion
Duration	46-51	36-38	33-36	24-26
Expenses	8-11	26-31	71-76	23-26
The risk of underutilization of the project's potential	41-51	31-36	46-51	6-21

The indicators and principles listed above required that each project be rigidly "embedded" in a single macro economic plan, which in reality proved difficult to implement. The main disadvantage of these indicators is their static nature, averaging, and abstraction from the real variability of project conditions and parameters. Currently, more informative dynamic indicators of the market economy have come into project practice - "net discounted income (NPV)" and "internal rate of return (IRR)", which are based on discounting actual cash flows over the project lifecycle. They are able to measure the dynamism of project parameters, the change in the price of money over time, and risk in one criterion. Due to these advantages, these indicators have been widely used in investment analysis of all industries. However, when using them, it is necessary to take into account the sectoral differences of projects, which usually relate to the extractive and processing sectors of the economy.

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