MODELING OF INVESTMENT MANAGEMENT OF THE INDUSTRIAL ENTERPRISES

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The most important investment management tool is modeling, which allows analyzing and forecasting the economic situation inside the enterprise and beyond, sales markets and markets for material and technical resources. In the process of modeling, a preliminary study of the object is carried out in order to highlight its essential characteristics, design the model, analyze the adequacy of the model to real economic processes and adjust it. In general, the problem of modeling relates to multicriteria problems of finding the optimal solution in the conditions of uncertainty and action of a large number of external and internal factors by determining the adequacy of the available resources of the enterprise necessary for the implementation of a specific innovation project [1-4].

The use of optimization models of investment management in the activity of industrial innovative enterprises will be considered in more details:

1. An optimization model without the involvement of a loan with full raw materials and equipment available. This model allows to calculate the production program of an innovative enterprise, provided that the company has stocks of raw materials, goods and equipment needed for manufacturing innovative products. It is assumed that the enterprise produces innovative products in different volumes, which are set by a certain set of production programs \( X = \{x^1, ..., x^N\} \), where \( x^k = (x^k_1, ..., x^k_n) \), but a production program \( k = (1, ..., N) \) specifies production volumes for all products of the species \( i \) \((i = 1, ..., n)\), where \( n \) - the number of types of products produced [5-8].

The following designations are used in this model:

\[ Z_{\text{const}} \] - fixed costs;
\[ a_i \] - the price of the unit of production of the species \( i \);
\[ b_i \] - variable costs of producing a unit of production of a species \( i \);
\[ c_i = a_i - b_i \] - margin income in the production of products \( i \);
\[ l_{ij} \] - rate of consumption of the resource \( i \), that is, the volume of the resource of the species \( j \) \((j = 1, ..., M\), where \( M \) - number of resource types), required to produce the unit of production of the species \( i \);
Lₗᵢ – stock of resource of the species i;

ₗᵢ - load time of the equipment unit of the species f (ᵢ = 1,..., K, where K - number of types of equipment) to produce a unit of production of the species i;

ₗᵢ - the number of units of equipment of the species f;

ₗᵢ - effective uninterrupted operation time of type f equipment, that is, the calendar time of the operational phase minus retrofitting time, routine maintenance and other types of work during which type f equipment cannot be used in the production process.

Thus, the function that maximizes the profit of the enterprise will look like (1):

\[ \sum_{i=1}^{n} c_i x_i - Z_{const} \rightarrow \text{max}. \]  

(1)

Restrictions are on resources and equipment (2):

\[ \sum_{i=1}^{n} l_{ij} x_i \leq L_j, j = 1, M; \]

\[ \sum_{i=1}^{n} t_{if} x_i \leq k_f t_f, f = 1, K; \]

\[ x_i \geq 0, x_i \in Z, \]

(2)

where Z - the set of integers.

This model uses one assumption: an enterprise loan is repaid at the expense of income from its innovation activity.

2. A credit-driven optimization model to increase production with partially available raw materials and equipment [9–11]. This model can be used in a situation where additional resources are involved in increasing the output. As in the previous model, an enterprise can, for a limited period of time, produce products in volumes specified by alternative production programs of the plural \( X = \{x^1, ..., x^K\} \), where \( x^K = (x^1_k, ..., x^n_k) \).

It will be assumed that the company attracts a loan in volume \( V \) for the purchase of additional material resources of production \( L_j^+ \) and equipment \( y_f \).

The following designations are used in the model:

\( V \) - the volume of the loan attracted at \( \alpha \) percent;

\( \beta_j \) - the unit price of a resource of a species \( j \) (\( j = 1, ..., M \));

\( y_f \) - unit price of the equipment of the type \( f \) (\( f = 1, ..., K \));

\( L_j^+ \) - the stock of resource of species \( j \);

\( k_f + y_f \) - the number of equipment units of the species \( f \).

The profit maximization feature of an innovative enterprise will be as it is shown in Formula 1 [8].

Restrictions on resources and equipment (3):

\[ \sum_{j=1}^{M} l_{ij} x_i \leq L_j + L_j^+, j = 1, M; \]

\[ \sum_{f=1}^{K} t_{if} x_i \leq (k_f + y_f) t_f, f = 1, K; \]

(3)

Restrictions on the amount of credit purchases (4):

\[ \sum_{i=1}^{M} \beta_i L_j^+ + \sum_{f=1}^{K} y_f y_f \leq V \]

(4)

Restrictions on integer values (5):

\[ x_i, y_f, L_j^+ \geq 0, x_i, y_f \in Z \]

(5)

The solution of the optimization problem will allow to determine the most optimal production program \( x = (x_1, ..., x_n) \), as well as purchase volumes of additional raw materials and equipment.

The solution of this optimization problem will allow to find a new production program, taking into account the product differentiation, the purchase of new types of
raw materials and equipment. The abovementioned optimized investment management models play a decisive role in the decision making process regarding the feasibility of implementing a particular innovation project.

References:


