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MODELING THE PROCESS OF FUNDING SOURCES SELECTION FOR ENTERPRISE INVESTMENTS

У статті запропоновано новий підхід до побудови певних економіко-математичних моделей для симуляції процесу вибору джерел фінансування інвестицій підприємства.

The article proposes a new approach to construction of certain economic and mathematical models to simulate the process of selecting funding sources for enterprise investments. It allows enterprises quickly and effectively select the exact structure of funding sources to provide the highest level of effectiveness in any specific case.

Key words: modeling, funding sources for investments, source attractiveness coefficient.

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How does an enterprise choose necessary funding sources? First, it is important to identify a number of criteria to be met by funding source (for example: fundraising speed or minimal cost of funds) [1; 2; 8]. The level of attractiveness for the enterprise is based on whether potential source matches selected criteria. Different criteria may be more or less important for companies. Therefore, to choose the best funding source (sources), it is necessary to calculate attractiveness coefficient for each potential source, and its weight will depend on whether given source answers selected criteria and the level of importance of each of these criteria to enterprise.

Selected economic literature on financing enterprise investments [1–8] suggests using the following criteria for source' selection for enterprises financing: time; [2; 6; 8] different types of risks [1; 2]; fundraising costs comparison from different sources [2]; payment terms from a viewpoint of maturity dates profitability at a convenient time for enterprise [3; 7]; probable limitations in the flow of funds [5; 8]; risk of control transition to another owner [4; 7].

Thus, taking into account given approaches, we can offer following criteria for source selection:

1. Fundraising speed from given source. All internal sources have the highest fundraising speed; external sources of funds attraction are different and depend not only on source, but also on number of subjective factors.

2. Risk of control transition to another owner. Risk of control transition to another owner can arise in case of attracting funds from domestic or foreign investors by selling them enterprise' shares. Risk rate depends on funds' volume, that enterprise is planning to raise from given source, and on terms of funds attraction. For example, in case of public (open) ordinary shares placement on stock market, the risk of losing control is quite high.

However, company can reduce this risk to minimum by making private placement of new emission among existing owners according to their share in capital.

3. Return of investment from a viewpoint of maturity dates profitability at a convenient time for enterprise. In case of the credit sources, compensation will consist of return of the debt body and interest on it. In this case, there are specific terms regulated by the credit agreement. Matching these terms with return of investment period for the project is key criteria for evaluating credit sources. In case of investment funds, specific terms of compensation are not determined since the company shares profits with the funds owner and it happens at a convenient time for enterprise. Thus, by the criteria of funds returning terms investment sources have an advantage.

4. Cost of the source. Cost of given source is very important to companies and depend on funds' price, fundraising cost, as well as tax benefits associated with given source.

5. The risk of failure to attract funds from given source. One of the criteria during selection process, from our point of view, is a risk of non-attraction or partial attraction of necessary funds for company, for example, a loan from a commercial bank may be denied. Another example of incomplete attraction could be partial placement of shares or corporate bonds that can happen in case of weak demand for these securities on stock market. In certain cases, negative effects of failure to attract funds can be quite low. Thus, if commercial bank rejected a loan, the company turns to another source while losing only time. However, in case of partial placement of securities company can lose a significant amount of money that has been spent on issue of these securities as well as intermediaries fees for market placement. Subjective reasons for total or partial failure to attract funds could be poor financial conditions or business reputation etc.

But there can also be objective reasons such as low supply of funds on capital market for investments or increase in interest rates, which will lead to objective inability of enterprise to raise funds with given price. Therefore, company must evaluate correspondence of source to certain criteria, taking into account both subjective and objective chances of attraction funds from this source. Each source can be evaluated with a scale of 0 to 1 point, the lowest score a source can get is 0 point, i.e. speed of fundraising is too low, risk or price are too high. Highest score the source can get is 1 point.

Enterprises in different ways can rate importance of certain criteria when selecting sources (eg time of fundraising could be of less importance for a company while cost of source could play a critical role). Thus, we introduce an indicator — criteria importance coefficient (W), which will act as a weight in formula that calculates source attractiveness. This indicator should be measured from 0 to 1. If score is 0, it means that matching funding sources with given criteria is not important for company. Thus, attractiveness coefficient of a single source should be calculated by multiplying score of i -th source for j -th criteria (A_{ij}) by criteria importance coefficient of j -th criteria (W_j). Since the calculation uses several criteria, attractiveness coefficient should be divided by the number of evaluation criteria. Thus, the formula for calculating the attractiveness coefficient of i -th source (K_i) will be as follows [6]:

where K_i — attractiveness coefficient of the i -th source; A_{ij} — score of i -th source for j -th criteria; W_j — criteria importance coefficient of j -th criteria; m — number of criteria for source selection; n — number of funding sources that are evaluated;

$i = 1, n; j = 1, m.$

Based on proposed formula, attractiveness coefficient can vary from 0 to 1. The closer the score to 1, the more attractive is given source of financing for investment projects.

Assume that company has four potential sources of investment for project financing: company profit; issue and public offering of common shares; issuance of bonds; loan from a commercial bank.

To define attractiveness coefficient of these financing sources, the following table should be filled (Table 1.) [6].

Table 1.

The attractiveness of the project funding sources

Criteria	criteria importance coefficient (W_j), $j=1,5$	Score evaluation of potential funding sources (A_{ij}), $i=1,4$			
		(A_1)	(A_2)	(A_3)	(A_4)
1. Fundraising speed					
2. Risk of control transition to another owner					
3. Term of funds return to their owners					
4. Cost of source					
5. Risk of failure to attract funds from a given source					
$\sum (A_{ij} \times W_j)$					
$(\sum (A_{ij} \times W_j)) / 5$					

As a result, company will get attractiveness coefficients for existing sources. Lets rank corresponding attractiveness coefficients K_i by their respective ranks R_i , which will determine the degree of attractiveness of funding source. In order to achieve the ultimate goal and find the optimal composition of funding sources we suggest the following actions' sequence. Company initially chooses the source that has the maximum value of attractiveness coefficient. Further, by multiplying attractiveness coefficient of given source by the amount of capital required for project, one can determine capital volume that will be attracted from this source and check how it meets the required (target) volume. If the amount of capital is less than required, company turns to funding source that has next rank of attractiveness coefficient and examines how the volume of capital from this source meets the needs of enterprise, reduced by the volume attracted from previously selected source. This process continues until needed amount of funds for the project financing is attracted from selected sources. Thus, company will compose the mix of the most attractive funding sources.

In a formalized manner process of source selecting can be represented as follows:

$$K_i = \max\{K_1, K_2, \dots, K_n\}; \quad Q_i = K_i \times V; \quad \sum Q_i = V,$$

where Q_i – capital volume that is attracted from i -th source; V – total capital volume required for investment project.

However, this system of equations requires some clarification. In a reality, amount of funds that can be attracted from each source has certain limitations. If undistributed

profit proves to be the most attractive source, it doesn't mean that the volume would be sufficient to finance investments.

Emission volume of preferred shares is also limited. Some sources are limited not only by maximum possible volume of attraction, but also by the required minimum. For example: additional issue of shares and issue of bonds. Fundraising from these sources requires certain costs for issuance and distribution (placement) of securities. Therefore, emission volume should exceed costs of its issuance. Furthermore, the higher the emission volume, the cheaper will be this source. Thus, we can conclude that there is a minimum required emission volume that makes this particular funding source reasonable.

To determine the optimal mix of funding sources for investment project, company needs to evaluate attractiveness coefficients of potential sources and choose those sources that have the highest level of attractiveness based on quantitative restrictions taking into account the maximum possible and necessary minimum that can be attracted from a given source. Considering all of the above, final version of the selection process the optimal mix of funding sources in a formalized form can be represented as follows:

$$\begin{aligned} K_i &= \max\{K_1, K_2, \dots, K_n\}; \\ Q_i &= K_i \times V; \\ M_i &\leq Q_i \leq N_i; \\ \sum Q_i &= V, \end{aligned}$$

where N_i – maximum possible volume of attraction from the i -th source; M_i – minimum necessary volume of attraction from the i -th source;

Based on this formalization we can build algorithm of funding sources selection for companies' investments. For this purpose we will use following definitions: n – number of potential funding sources; k_1, k_2, \dots, k_n – attractiveness coefficients of 1st, 2nd, ..., n -th funding source, respectively; K – set of k elements; V – total capital volume required for the project; M_1, M_2, \dots, M_n – minimum required volume of fundraising from 1st, 2nd, ..., n -th funding source respectively; N_1, N_2, \dots, N_n – maximum volume of fundraising from 1st, 2nd, ..., n -th funding source respectively; Q_1, Q_2, \dots, Q_n – capital volume that should be attracted from 1st, 2nd, ... n -th funding source respectively; j – step number.

Block diagram of the algorithm of funding source selection for enterprise investments is shown in Fig. 1.

This algorithm allows to determine not only mix of funding sources, but also their structure, i.e. capital volume that should be attracted from each of selected sources. Thus, the study we conducted revealed main criteria that determine the attractiveness of certain funding sources for projects financing, and on a basis of their scoring was developed formula of source attractiveness coefficients. However, there could be other options, because in general, value that determines attractiveness of the i -th funding source can be represented as follows (6) :

$$K_i = f(X_{1i}, X_{2i}, \dots, X_{mi}) + U_i,$$

where K_i – attractiveness of i -th funding source; $X_{1i}, X_{2i}, \dots, X_{mi}$ - factors that determine attractiveness of i -th funding source, i - funding source, $i = 1, n$; n - number of funding sources; m – number of attractiveness factors; U_i - disturbance that includes the amount of unaccounted factors.

This ratio provides another approach to formal representation of mechanisms for determination of optimal mix of funding sources, namely, it can already be seen as a regression equation describing the processes associated with assessment of certain source attractiveness. Parameters of this model (i.e., coefficients according to relevant variables) with such approach can also be seen as relevant assessments that are listed in the table made by company itself.

Proposed general concept of source attractiveness coefficients will help to formalize the process of source selecting for financing companies' investments that will further allow developing the idea of process modeling of financing companies' investments as a whole and its individual aspects in particular.

Practical usage of the algorithm, built on the basis of given formalization, will allow companies to increase efficiency of selecting funding sources, and thus the effectiveness of financial support for investments in general.

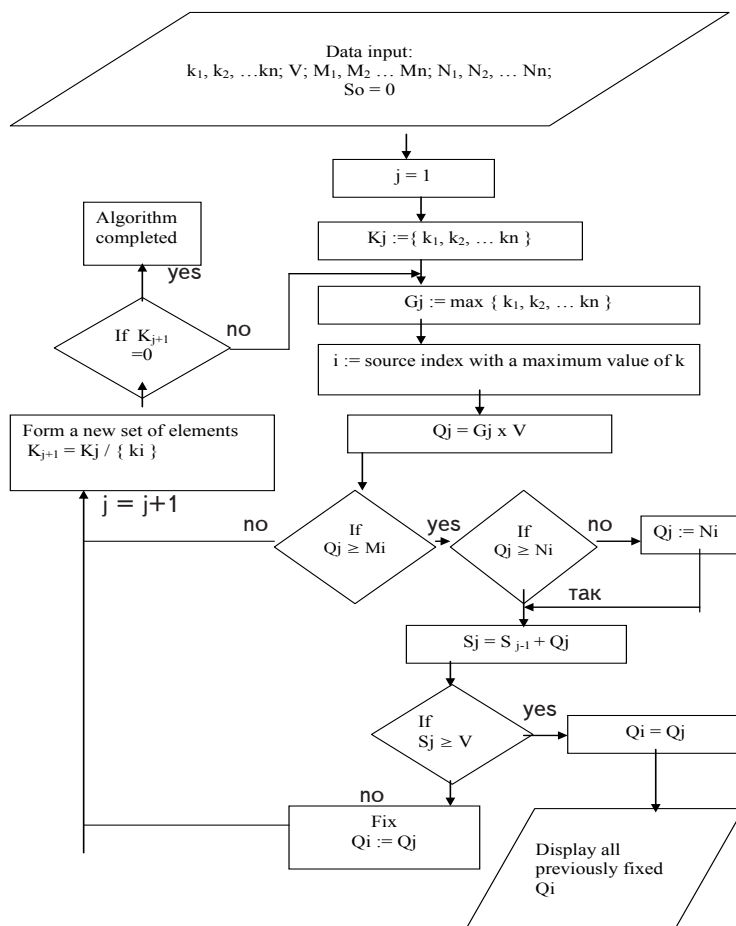


Figure 1. Block diagram of the algorithm of funding sources selecting for company' investments

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