

ENHANCEMENT TECHNOLOGY SECURITY ACTIVITIES OF VENTURE CAPITAL FUNDS

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Abstract: It is given the approach for developing the information technology that allows to increase the safety of operating venture capital funds. This technology uses the method of start-up projects assessment in conditions of uncertainty and evaluation of sectors of the economy in which the project is implemented. There is described the necessity of the occupation "Venture Manager" for the efficient and safe operation of the venture business.

Keywords: secure financing, startup projects, risk, venture manager, venture capital, project assessment, economics, decision making.

1. INTRODUCTION

With the development of information technologies companies generating technological ideas are also developed. For the realization of ideas and the establishment of becoming an independent ready for sale product funding is necessary. One source of financing is venture capital funds. Specification of the functioning of venture capital funds is in its title (eng. "risk appetite" – venture) and its profit is in the purchasing shares of the start-up campaign at the expense of investing in those funds. The main features of venture capital financing are: relatively small amounts of the proprietary; the risk opportunity of investing in the early stages of startups; direct participation of the Fund in the management of the investee company; the receipt of income through the sale of ownership shares of the company; the possibility of risk diversification.

The basis of the risk management of venture capital funds is to diversify small sums of investments in various projects. The optimum is an activity with the simultaneous funding of several projects or co-financing of projects by several venture capital funds. The activities of the venture business can be successful if venture Fund, start-up company and the "venture Manager" work simultaneously. "Venture Manager" – the person or company that assists in finding investors for a startup and helps investors to assess the risks of start-up projects and build ranged rank of their successfulness [1].

Thus, to ensure the economic security of the functioning of venture capital funds and the reasonableness of decision-making on financing of innovative project, there is an urgent task to develop a technology for assessing the risk of financing a startup project.

To solve this problem we suggest to develop an information technology assessment start-up projects in conditions of uncertainty of input data and evaluation sector of the economy which the project is implemented in. Basing on generated estimates it becomes possible to make an adequate decision about the financing of the startup project, and to increase the safety of operation of the venture Manager. The creation of this technology involves the development of mathematical apparatus and software design of a web-platform. Use of this web-platform will allow to venture Manager adequately estimate start-up projects, find an investor for them and reduce the risk of financing by the venture capital funds.

2. STRUCTURED SCHEME OF SOLVING THE PROBLEM

One of the main reasons of disagreements between the entrepreneur and the venture capital Fund is the lack of communication between the two parties, i.e. investors are often not very well by explaining their need and the method of repayment, and sometimes venture Fund decides to eliminate the founder and hire an experienced Executive Director, as well as the mismatch of ambitions.

"Venture Manager" can perform following functions: portfolio management of innovative projects (selection, assessment, portfolio balancing, optimization, monitoring); management of the actual innovation project (planning, implementation, market entry, financing, personnel management); management of financial, commercial and technical risks; financial management of innovative enterprise; monitoring and control. Therefore, the venture Manager can act as an intermediary between the venture Fund and entities for funding. In this regard, the venture capital Manager needs a new paradigm for successful and high-quality functioning.

To solve this problem a fuzzy sets theory is used to build mathematical models of start-up project assessment and sector of the economy in which the project is implemented. Structural scheme of mathematical model presents challenges for information technology could be the following (Fig. 1).

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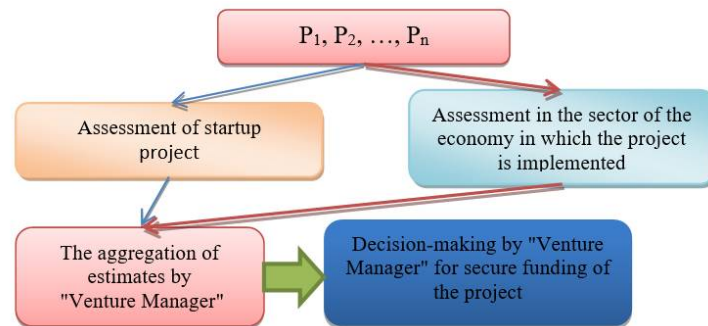


Fig. 1. Structural scheme of mathematical model

At the entrance we have projects P_1, P_2, \dots, P_n with various perspectiveness, nature and security of realization. On the output we have evaluated projects in reference to the security level of their realization.

2.1. Mathematical models of solving the problem

To assess startup projects an evaluation startup model has been developed in the conditions of information uncertainty [2]. Here is the following algorithm for constructing initial assessment under the proposed model.

Step 1. For a current startup P to conduct an expert survey and calculate the convolution sum of scores on the relevant criteria $\{G_1, G_2, \dots, G_5\}$.

Step 2. The decision maker (DM) sets his own wishes concerning the desired values of a $T = (t_1, t_2, \dots, t_5)$ vector group criteria.

Step 3. The calculated values in the membership functions for the received scores of a startup and "desired values":

$$\mu_{G_i}(g_i, a, b) = \begin{cases} 0, & g_i \leq a; \\ 2\left(\frac{g_i - a}{b - a}\right)^2, & a < g_i \leq \frac{a + b}{2}; \\ 1 - 2\left(\frac{b - g_i}{b - a}\right)^2, & \frac{a + b}{2} < g_i < b; \\ 1, & g_i \geq b. \end{cases} \tag{1}$$

a – convolution of a minimum amount of points, b – is the convolution of the sum of the maximum points of the tonal range of the assessment criteria in the group G_i , g_i – the convolution sum of scores on the scale for the considered gradating startup ($i = \overline{1,5}$).

Step 4. Find the values of the membership functions relative to the scoring and the "desired values", e.g.:

$$\mu_{U1}\left(x; \alpha - \frac{\alpha}{2}; \alpha - \frac{\alpha}{4}\right) = \begin{cases} 1, & x \leq \alpha - \frac{\alpha}{2}; \\ \frac{3\alpha - 4x}{\alpha}, & \alpha - \frac{\alpha}{2} < x \leq \alpha - \frac{\alpha}{4}. \end{cases} \tag{2}$$

As a result, for each group of criteria under current startup we receive a linguistic value and a score of confidence.

Step 5. DM expresses his thoughts on the terms (desired terms) for groups of criteria – U^* .

Step 6. Calculate assessments $\mu(O_i)$, due to the received and desired terms up to:

$$\mu(O_i) = \max\{\mu(A_i); \mu(B_i)\}, \tag{3}$$

Where $\mu(A_i) = \begin{cases} \mu U_{ij}, & U_{ij} = U_{ij}^* \\ 0, & U_{ij} \neq U_{ij}^* \end{cases}$ and $\mu(B_i) = \begin{cases} \frac{\mu U_{ij}}{2}, & U_{i(j\pm 1)} = U_{ij}^* \\ 0, & U_{i(j\pm 1)} \neq U_{ij}^* \end{cases}$ ($i = \overline{1,5}$).

Step 7. The DM specifies weights for each group of criteria $\{p_1, p_2, \dots, p_5\}$ and uses its standardization in accordance with:

$$w_i = \frac{p_i}{\sum_{i=1}^5 p_i}, \quad i = \overline{1,5}; \quad w_i \in [0,1]. \tag{4}$$

Step 8. Using the average weighted convolution we calculate the aggregated rating

$$O_P = \sum_{i=1}^5 w_i \cdot \mu(O_i), i = \overline{1,5}. \quad (9)$$

The estimation of the startup project will be normalized from the interval [0;1].

To assess the sectors in which the project is implemented we use the developed method of ranking alternative options of heterogeneous nature [3]. The proposed algorithm allows to solve adequately such a complex problem as the assessment of functioning industries of economy for investment opportunities. Aggregated assessment of the functioning sectors of the economy will be normalized to the interval [0;1] and will be denoted by O_S .

Thus, the "Venture Manager" will receive an adequate and objective evaluation of the startup project O_P and an assessment of the sectors of the economy in which the project is being implemented O_S . The aggregation of estimates is done by "Venture Manager" according to the following formula:

$$m = w_1 \cdot O_P + w_2 \cdot O_S, \quad (10)$$

Where w_1 is the normalized weighting factor of the evaluation of the startup project, and is the normalized weighting factor of evaluation of sectors of economy.

2.2. Decision making by the venture manager in the project financing safety

Lets introduce a linguistic variable $M(m)$ = "the security level of financing of the project". Universal set for the variable $M(m)$ is the segment [0; 1], and a set of values of the variable m - $M = \{m_1, m_2, m_3, m_4, m_5\}$, where:

m_1 = «very low level of project financing security»; m_2 = «low level of project financing security»; m_3 = «medium level of project financing security»; m_4 = «above average level of project financing security»; m_5 = «a high level of project financing security».

To establish a linguistic project evaluation the value obtained by the formula (10) is comparable to one of the term sets $M = \{m_1, m_2, m_3, m_4, m_5\}$. The scale of marks can be determined as follows: $m \in (0,67; 1] - m_5$; $m \in (0,47; 0,67] - m_4$; $m \in (0,36; 0,47] - m_3$; $m \in (0,21; 0,36] - m_2$; $m \in [0; 0,21] - m_1$.

Thus, the initial evaluation of the project will be aggregated evaluation of the project and the level of security of its funding. Based on this the further decision is made by a venture capital Manager towards the financing of the project.

3. CONCLUSIONS

The economic security of the functioning of venture capital funds directly depends on the decision on financing those or other innovative projects. Therefore, the establishment of evaluation technology and the establishment of levels of security for the financing the projects will improve the safety of venture capital funds operation. This technology works in conditions of uncertainty of input data and reveals the subjectivity of the evaluation basing on the promising sector of the economy in which the project is being implemented. The embodiment of the created technology into software (web platform) will allow to assess adequately innovative (startup) project by a venture Manager, to find the appropriate investor to the project and to reduce the risks of financing by the venture capital funds and improve their safety.

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