ANALYTICAL SUPPORT FOR MANAGEMENT OF VENTURE FINANCING OF INNOVATIVE ENTERPRISES

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Abstract: *This article deals with the peculiarities of innovative enterprises management in the conditions of risk and uncertainty of the economy. Innovative type of modern economy development envisages intensification of processes in the field of alternative sources search of business financing for enterprises support and development, as well as sustainable development in the country. One of the available sources of financing innovative activity of small and medium enterprises is venture financing.*

The economic strategy of any country should be based on the fact that only the activation and effective use of its innovative potential will be able to ensure the sustainable development of the economy and society as well as will radically change the factors of its attractiveness for foreign investors.

Taking into account the need to provide management stuff with operational information on the availability and condition of venture financing at the enterprise, a two-step method of economic analysis of venture financing has been suggested aimed at improving the information base for the formation and use of attracted venture investments in the form of own and loan venture capital, its quantity and quality, which allows to define the further method of management of its elements in the operational mode.

Having calculated the suggested indicators based on the data of the activities of innovative enterprises of Ukraine, Russia, Poland and Bulgaria, we can conclude that the share of venture financing of innovative enterprises in the form of own venture capital (i.e, the acquisition of shares of the enterprise by venture capital investors) in the total amount of venture financing is larger, compared with a share of venture financing of an innovative enterprise in the form of loan capital (through the acquisition of venture company bonds). This is due to the fact that, first of all, venture financing is a risky investment, thus venture investors are trying to reduce the risks of such financing, mainly using financing in the form of acquiring shares of the innovative enterprise. As the result of research methodic provisions of the analysis of innovative enterprises venture financing have been improved by developing a complex analysis method of condition, availability and efficiency of venture financing in the part of factor analysis of the profitability of own as well as loan venture capital, by multiple regression model building for defining the impact of venture capital on the results of enterprise's innovation activity, enable to identify cause-effect relationships for the development of appropriate measures to optimize risk venture funding as well as finding ways to attract additional financial resources from venture capital investors.

Key words: *innovation potential, sustainable development, innovative enterprises, venture financing, multiple regression model*

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1. INTRODUCTION

Economic analysis is a necessary management function that, based on accounting data and reporting, provides information to management staff in the form of analytical summaries. The management of an innovative enterprise is carried out under conditions of risk and uncertainty of the economy, therefore the overall assessment of the activity of the innovative enterprise, and subsequently an in-depth analysis of the efficiency of the use of venture financing, will improve the management of the venture capital investments and will provide the opportunity to make sound decisions on the directon of usage as well as the necessity for additional attraction of venture financing.

The amount of venture financing should meet the needs and capabilities of the enterprise to create and implement innovative products. The effectiveness of venture financing of an innovative enterprise depends on how economically feasible they are. In the long run, the most important criterion for the effectiveness of using venture financing in general is the stable financial position of the company and the prospect of its future development, that is, its solvency, liquidity, business activity, financial sustainability, profitability of its activity.

The essence of the issue of increasing the efficiency of the use of venture financing is that for each of its unit we should achieve the maximum possible increase in production and profits. Quantitative certainty and the content of the criterion is reflected in specific indicators of the effectiveness of the use of venture financing of economic entities. In addition, the availability and state of venture financing at the enterprise is a top priority in predicting bankruptcy, since its value is first and foremost taken into account in existing methods.

2. COMPLEX METHODOLOGY OF ECONOMIC ANALYSIS OF VENTURE FINANCING OF INNOVATION ENTERPRISES

Taking into account the necessity of providing management staff with operational information on the availability and state of venture financing at the enterprise, we consider it expedient to carry out the analysis in a phased manner: a general analysis of the activity of the innovative enterprise and an in-depth analysis of the efficiency of the use of venture financing. The lack of an integrated methodology for analyzing venture financing leads to ineffective enterprise policy on the use and attraction of the required amounts of venture financing. This, in turn, causes a deterioration of the overall economic situation of an innovative enterprise. In the process of studying the peculiarities of venture financing, it has been established that venture financing can be in two forms, due to its dual nature, namely in the form of own and borrowed capital, therefore we have identified objects of analysis of venture financing: own venture capital, loan venture capital.

Consequently, the suggested methodology of general evaluation of the financial state of the innovation enterprise includes: 1. Analysis of the economic potential of the enterprise. 2. Analysis of the development and performance of the enterprise. 3. Analysis of the probability of insolvency and bankruptcy of the enterprise. The methodology of general assessment of the financial state of the innovation enterprise corresponds to the generally accepted methodology of carrying out the analysis of the economic potential of the enterprise, analysis of the development and performance of the enterprise, analysis of the probability of insolvency and bankruptcy of the enterprise [1-6; 8-10].

Let's stop more closely on the methodology of in-depth analysis of venture financing, which involves four main areas: 1. Assessment of the availability and state of venture capital. 2. Factor analysis of profitability of own and borrowed venture capital. 3. Analysis of the effect of the amount of the use of venture financing on the total profit by constructing a multiple regression model. 4. Analysis of the effectiveness of the venture investment project. The main objects of analysis at this point are: own and borrowed venture capital, growth rate; the proportion of individual components of venture capital is calculated, including structural changes of venture capital are studied; the assessment of the level of venture financing provision of the enterprise as well as a number of coefficients is calculated.

First of all, it is necessary to assess the level of venture financing or venture capital provision of an innovative enterprise by analyzing its availability, state and composition. During the implementation of this stage: the cost and growth rate of the components of the venture capital of the innovative enterprise in absolute terms are defined; the proportion of individual components of venture financing is calculated; the dynamics of the structure of venture capital for a number of reporting periods is studied, the relationship between different types of venture capital is estimated; the influence of the change of the structure of venture capital on the coefficients and the results of the enterprise activity by using the models of deterministic factor analysis is determined; an assessment of the level of the venture financing provision of the company is given, for this aim a number of factors is calculated.

The phase of in-depth analysis of venture financing, which involves analyzing the provision of innovative products by venture financing, characterizes the level of innovation products financing provision in the form of own and / or borrowed venture capital. At the present stage, we suggested to calculate the following coefficients: the coefficient of providing innovative products with its own venture capital (CPIP_OwVenchC), the coefficient of providing innovative products by the borrowed venture capital (CPIP_BVenchC), the coefficient of providing innovative products with venture capital (CPIP_VenchC), which characterize which part of the innovation products is provided by own or borrowed sources of venture financing, as well as overall by venture capital. At the stage of determining the effectiveness of venture financing it is expedient to determine the following indicators of profitability: the profitability of own venture capital (POwVenchC), profitability of borrowed venture capital (PBVenchC), probability of venture financing (venture capital) (PVenchF(VenchC)). The calculation of these indicators reflects the level of additional

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income for venture capital in different variants of the structure of the sources of its formation and shows how many percent will increase the profitability of venture financing as a result of obtaining funds from venture capital investors in the form of either own or borrowed venture financing.

Having calculated the suggested indicators based on the data of the activities of innovative enterprises of Bulgaria, Poland and Russia and the amounts of their venture financing, we can conclude that the share of venture financing of innovative enterprises in the form of own venture capital (i.e. share acquisition by venture capital investors) in the total amount of venture financing compared to the share of venture financing of an innovative enterprise in the form of borrowed capital (through the bond acquisition of venture company) is larger. This is due to the fact that, first of all, venture financing is a risky investment, so venture investors are trying to reduce the risks of such financing, mainly using the form of financing in the form of acquiring shares of the innovative enterprise.

Also, it is equally important in the process of analyzing the availability and state of venture financing of innovative enterprises, its high profitability, and, accordingly, the calculations carried out − from 6.99% to 9.78%. That is, in the case of venture financing of enterprises − the risk is justified, as in the case of successful implementation of innovative products, venture capital investors are able not only to repatriate primary investments, but also to obtain high profits, which is not typical for other types of capital investments.

3. FACTOR ANALYSIS OF PROFITABILITY OF OWN AND BORROWED VENTURES CAPITAL

Without factor analysis of the indicator of the profitability of own and borrowed venture capital, it is impossible to take into account all factors that will have an impact on the financial performance of an innovative enterprise. This is first and foremost the features of innovative products, the quality of managerial abilities of the management of the enterprise, the choice of areas for the use of venture financing, etc. Therefore, the next step in the in-depth analysis of venture financing is important − this is a factor analysis of the profitability of own and borrowed venture capital. To calculate the influence of factors on the change in the profitability of own and borrowed venture financing, we use the acceptance of expansion of factor systems. On the basis of this reception, the following factor model was constructed:

$$P_{VenchF(VenchC)} = \frac{FR}{VenchC} = \frac{FR}{VenchC} \times \frac{BVenchC}{BVenchC} \times \frac{OwVenchC}{OwVenchC} = \frac{FR}{OwVenchC} \times \frac{OwVenchC}{BVenchC} \times \frac{BVenchC}{VenchC} \quad (1)$$

where FR – financial result before taxation (total profit) of the innovative enterprise; VenchC – total amount of venture capital; OwVenchC – own venture capital; BVenchC – borrowed venture capital.

However, comparison of financial results before tax with the amount of own venture capital allows to calculate the profitability of its own venture capital (POwVenchC) and shows the effectiveness of its use. In addition, comparison of the amount of own and borrowed venture financing among each other allows to determine the stability coefficient of venture financing (C$_{StVenchF}$) and compare borrowed venture capital with venture capital in general − concentration coefficient of borrowed venture capital (C$_{ConcBVenchC}$). In view of the above, the effective probability indicator of venture financing will be presented in the form of a multiplicative model:

$$P_{VenchF\,(VenchC)} = P_{OwVenchC} \times C_{StVenchF} \times C_{ConcBVenchC} \tag{2}$$

We will test the specified factor model, using the initial data of the activities of the innovative enterprise of Ukraine during 2016-2017.

Indicator	2016.	2017	Absolute deviation
The amount of venture financing in the form of own capital (OwVenchC), thou. UAH	870,0	985,0	+115,0
The amount of venture financing in the form of borrowed capital (BVenchC), thou. UAH	980,0	982,0	+2,0
Total amount of venture capital (VenchC), thou. UAH	1850,0	1967,0	+117,0
Financial result before taxation (total profit) of the innovative enterprise (FR), thou. UAH	7100,0	8450,0	+3971,0
Stability coefficient of venture financing (CSTVenchF)	0,89	1,0	+0,11
Concentration coefficient of borrowed venture capital (CConcBVenchC)	0,53	0,5	–0,03
Profitability of venture financing (venture capital) (PVenchC)	3,84	4,3	+0,46
Profitability of venture financing attracted in the form of own capital (POwVenchC)	8,16	8,58	+0,42

Table 1: Output data for factor analysis of the venture capital profitability (venture financing) of the Ukrainian innovation enterprise

Using the method of absolute differences, we will conduct a factor analysis of the profitability of venture financing of the innovation enterprise of Ukraine:
Δ PVenchC (POwVenchC) = 8,58*0,89*0,53 – 3,84 = 0,21 points;
Δ PVenchC (CStVenchF) = 8,58*1,0*0,53 – 4,3 = 0,25 points;
Δ PVenchC (CConcBVenchC) = 8,58*1,0*0,5 – 4,55 = -0,26 points;

Thus, in 2017, an increase in the profitability of venture financing by 0.46 points is observed at the enterprise of Ukraine, indicating an improvement in the efficiency of the use of such financing. This increase in profitability was due to the following factors: increased profitability of own venture financing led to an increase in the profitability of total venture financing by 0.21 points; the increase of the coefficient of stability of venture financing also positively influenced the profitability of venture financing, which led to an increase of 0.25 points; the decrease of the coefficient of the concentration of borrowed venture capital by 0.03 points negatively affected the profitability of venture financing and led to its decrease by 0.26 points.

Consequently, the increase of profitability of venture financing in the form of own capital and the stability coefficient of venture financing had the positive impact on the increase of the profitability of venture capital, while a decrease in the concentration coefficient of the borrowed venture capital of the innovative enterprise of Ukraine had the negative impact on the profitability of venture financing.

4. ANALYSIS OF THE INFLUENCE OF THE AMOUNT OF USAGE OF VENTURE FINANCING ON GENERAL PROFIT BY THE CONSTUCTION OF MULTIPLE REGRESSION MODEL

As it is rather difficult to reflect the link between the results of the enterprise and the level of use of venture financing, since only a set of factors in their relationship can give a more or less complete picture of the nature of the phenomenon under investigation. In this case, it is advisable to create a mathematical model based on the methods of multi-factor correlation-regression analysis, which will allow assessing the degree of influence on the researched productive indicator (results of the activity of the innovation enterprise) on each of the factors (own venture capital and borrowed venture capital) introduced into the model at a fixed position on the average of other factors. Multi-factor correlation analysis involves the following stages of constructing a multiple regression model: identification of factors that influence the investigated indicator, and the choice between them is essential for the implementation of correlation analysis; accumulation and evaluation of the source information for the correlation analysis; studying the nature and constructing a model of the relationship between factors and a productive indicator (compiling a mathematical equation that most accurately

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reflects the nature of the investigated dependence); realization of calculation of indicators of correlation relationship; statistical estimation of the results of correlation analysis and their practical application.

Following the selection of factors (in our case, this is our own and borrowed venture capital) and the corresponding assessment of the source information, an important task of the correlation analysis is to model the relationship between the factor and the performance indicators, that is, the selection of the corresponding equation, which will best characterize the investigated relationships.

If the relation between all the factor indices with the resultant is straightforward, then a linear function is used to record such dependencies [7, c. 91]:

$$Y = b_0 + b_1 x_1 + b_2 x_2 + ... + b_m x_m ,$$

(3)

where Y is the calculated regression value, which is an estimate of the expected value of Y for fixed values of the signs $X_1, ..., X_m$;

$X_1, ..., X_m$ are the most significant independent variables;

b_0 is a parameter that shows the average impact on the resultant indicator of factors that are not included in the model (or not highlighted to the study);

$b_1, ..., b_m$ − regression coefficients, each of which shows by how many units will change Y with the change of the corresponding sign of x per unit, in condition that the last signs are not changed.

We will test the above methodology for constructing a multiple regression model to determine the impact of the components of venture financing (own and borrowed venture capital) on the financial results (total profit) of Ukrainian enterprises. Then the regression equation will have the following form:

$$Y = b_0 + b_1 x_1 + b_2 x_2,$$ (4)

where X_1 − attracted venture financing in the form of own capital,

X_2 − attracted venture financing in the form of borrowed capital,

b_0, b_1, b_2 − parameters of the regression equation that can be calculated by the least squares method, solving the system of normal equations (5):

$$\begin{cases} \sum y = nb_0 + b_1 \sum x_1 + b_2 \sum x_2, \\ \sum yx_1 = b_0 \sum x_1 + b_1 \sum x_1^2 + b_2 \sum x_1 x_2, \\ \sum yx_2 = b_0 \sum x_2 + b_1 \sum x_1 x_2 + b_2 \sum x_2^2 \end{cases}$$ (5)

Output data for the solution of the system of equations are given in Table 2, and the estimated data in Table 3, respectively.

Year	Financial Result (y), mln. UAH	The amount of venture capital in the form of own capital, mln. UAH (X_1)	The amount of venture capital in the form of borrowed capital, mln. UAH (X_2)
2008	1 250	145	89
2009	1 436	199	92
2010	1 596	235	96
2011	1 745	241	101
2012	1 986	255	125
2013	2 015	269	132
2014	2 256	270	145
2015	2 560	279	156
2016	2 896	299	170
2017	3 033	356	196

Table 2: Output data for the enterprise for the correlation analysis

$\sum y$	$\sum yx_1$	$\sum yx_2$	$\sum x_1$
20773	5038061	2900321	2548
$\sum x_2$	$\sum x_1^2$	$\sum x_2^2$	$\sum x_1 x_2$
1302	678196	181528	348777

Table 3: Estimated data for determining the parameters of the regression equation

Let us substitute the obtained data (Table 3) into the system of normal equations (6):

$$\begin{cases} 20773 = 10b_0 + b_1 2548 + b_2 1302, \\ 5038061 = b_0 2548 + b_1 678196 + b_2 348777 \\ 29003212 = b_0 1302 + b_1 348777 + b_2 181528 \end{cases}$$

(6)

We find the determinant of the system and partial determinants, on the basis of which we calculate the parameters of the regression equation:
$\Delta = 578749878$; $\Delta b_0 = 152531299074665$; $\Delta b_1 = 4508569565822$; $\Delta b_2 = 7660940579250$ and, respectively, $b_0 = 263553.06$; $b_1 = 7790.19$; $b_2 = 13237.05$.

Then the equation of relationship, which determines the dependence of the resultant sign of the total profit on two factors (own and borrowed venture capital), will have the following form: $Y = 263553,06 + 7790,19 \, x_1 + 13237,05 \, x_2$.

Thus, with the increase of venture financing at the expense of own capital instruments for 1 UAH total profit grows by UAH 7790.19, and with the growth of venture financing at the expense of borrowed capital instruments per unit, the total profit increases by 13237.05 UAH. The above equation allows us to construct a trend line and carry out a forecast for subsequent years regarding the size of the total profit depending on the change in the amount of separate own and borrowed venture capital. However, based on the coefficients of regression, one cannot judge which factor most influences the result, since the regression coefficients are not comparative to each other. In order to identify the relative strength of the influence of individual

factors and their reserves, statistics calculates the partial elasticity coefficients ε_1 by the formula [7, с. 95]:

$$\varepsilon_i = b_i \frac{\overline{x_i}}{\overline{Y}};$$

(7)

where b_i − coefficient of regression at the i-th factor; $\overline{x_i}$ − average value of the i-th factor; $\overline{Y}$ − average value of the calculated (theoretical) dependent variable.
Partial coefficients of elasticity indicate by how much percentage dependent variable will change in average with change of 1% of each factor and the fixed position of other factors.

Accordingly, the coefficients of elasticity are:

$$\varepsilon_1 = b_1 \frac{\overline{x}_1}{\overline{Y}} = 7790{,}19 \cdot \frac{254{,}8}{3971957{,}38} = 0{,}4997;$$

$$\varepsilon_2 = b_2 \frac{\overline{x}_2}{\overline{Y}} = 13237{,}05 \cdot \frac{130{,}2}{3971957{,}38} = 0{,}4339.$$

$$(8)$$

The analysis of partial elasticity coefficients shows that the greatest impact on the total profit has own sources of venture financing, in particular, with an increase in the value of own venture capital by 1%, the total profit increases by 49.97%, and with an increase in the value of borrowed venture capital by 1% the total profit increases by 43.39%.

The tightness of the link between the resultant sign and the set of factor characteristics is studied using the aggregate determination coefficient [7, c. 96]:

$$R^2_{yx_1x_2\ldots x_m} = \frac{\sigma^2_{yx_1x_2\ldots x_m}}{\sigma^2_Y},$$

$$(9)$$

where $\sigma^2_{yx_1x_2\ldots x_m}$ – dispersion of theoretical values of the dependant variable, calculated with the multiple regression equation; σ^2_Y – total variance (dispersion of the actual y).

The aggregate determination coefficient characterizes the percentage of the variation of the dependant variable, which is linearly related to the variation of factors included in the regression equation.

The theoretical variance is calculated by the formula [7, c. 96]:

$$\sigma^2_{yx_1x_2\ldots x_m} = \frac{1}{n}\left(b_0 \sum y + b_1 \sum x_1 y + b_2 \sum x_2 y + \ldots + b_m \sum x_m y\right) - \overline{y}^2$$

$$(10)$$

Substituting the necessary formulas for the given data, we obtain: $R^2 = 0{,}78$. Thus, at the investigated innovation Ukrainian enterprise, 78% of the variation in total profit is linearly related to different levels of indicators of own and borrowed venture financing.

5. CONCLUSION

The study of theoretical approaches to the economic analysis of venture financing of innovative enterprises in modern conditions will provide an opportunity to determine the efficiency of obtaining information by management staff regarding the availability, state and composition of the attraction of this type of financing. Taking into account the lack of a comprehensive methodology for economic analysis of venture financing of innovative enterprises and the importance of its availability and efficiency in the enterprise, a step-by-step methodology of economic analysis of venture financing at the innovation enterprise has been suggested, which involves the implementation of a general assessment of the financial state of the innovation enterprise and an in-depth analysis of venture financing at the enterprise. At the stage of

carrying out a general assessment of the financial state of the innovation enterprise it has been suggested to carry out: 1. Analysis of the economic potential of the innovative enterprise. 2. Analysis of the development and performance of the innovative enterprise. 3. Analysis of the probability of insolvency and bankruptcy. Conducting in-depth economic analysis of venture financing in the company depends on the management's decision. The procedure of in-depth analysis of venture financing has been suggested, which involves assessing the availability and state of venture capital, conducting factor analysis of the profitability of own and borrowed venture capital, analyzing the impact of the amount of used venture financing on total profit by constructing multiple regression, analyzing the effectiveness of a venture investment project.

The ultimate performance of an innovative business depends on its ability to effectively use financing of venture investors. In the process of in-depth analysis of venture financing, much attention should be paid to factor analysis of the effectiveness of its use. Factor analysis of the efficiency of the use of venture financing of innovative enterprises determines the need to identify the direct factors that affect it. The efficiency of using venture capital depends on many factors, in particular, on external factors such as the general economic situation in the country, the level of targeted financing, interest rates on loans, etc. It is also important to analyze the impact of the level of venture financing of innovative enterprises on the financial result of operating activities by constructing multiple regression, since the ultimate operating performance of any business entity depends on its ability to effectively use available financial resources that are involved by venture financing, which occupies a significant place in the financing of risky innovation projects.

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