ANALYSIS OF STABILITY IN INDUSTRIAL ENTERPRISES INNOVATION POTENTIAL MANAGEMENT

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This article discusses the methods for evaluating and modeling innovation potential of an industrial enterprise. It gives account of the study based on the sustainability on the goal of the innovative potential of the organization on the example of oil and gas industry.

At the moment in Russian economy there is the misbalance between the availability of innovative opportunities and their realization in actual practice. One reason for this is related to the lack of comprehensive research, methodological and conceptual approach to the assessment and prediction of the innovative potential of industrial enterprises with the aim of improving their efficiency and economic sustainability.

The value of innovation potential is a parameter that allows the company to assess the possibilities of innovation and the strategy of innovation development. The effectiveness of innovative models of management may be determined by the economic outcomes identified through quantitative and qualitative assessment of the innovation potential.

An objective approach assumes the existence of adequate statistical information to assess the possibility of an event under the assumption of the invariability of the factors influencing the occurrence of this event. The drawback of such approach is the subjective evaluation of the persons related to the risk.

The phenomenon of sustainability is seen as a fundamental feature of any economic system. It can be defined as the permanence, the continuity of a certain state of the system and the transition from any other states into this one (static sustainability) and the development of the system (dynamic sustainability). The main properties for quantitative assessment of the innovation potential are: the monotony, the limitation, the comparability; the assessment of innovation potential should not only depend on the characteristics of the studied organizations, but also on the characteristics of other organizations with similar specialization and approximately the same geographic location.

The quantification of innovative potential may be determined by the analysis of an expanded version of the multiplicative Cobb-Douglas model:

$$R = \prod_{t=1}^{T} F_t^{\alpha_t},$$

where R is the value of the resulting indicator (e.g. commercial products). The α_t parameters are determined by the method of least squares for the combined surveyed organizations.

By defining the α_t parameter estimates, innovative potential is proposed to determine the formula that satisfies the conditions set forth in the assessment of the innovation potential:

$$P_i(S_i) = \frac{2arctg\left(\prod_{t=1}^{T}\left(\frac{F_{ti}}{R_i}\right)^{-\alpha_t}\right)}{\pi}, i = 1..N,$$

where N is the number of the surveyed organizations, S_i is the structure of the important characteristics determined for the organizations in question, F_{ti} is the numerical value of t-th characteristic, R_i is the importance of the effective rate for the i-th researched organizations.

The characteristics considered in this case include the major technological, institutional and economic parameters of the organization. In the course of the study we have selected following characteristics of the innovative potential of the organization:

Characteristics of the 1st level:

1. Net value of fixed assets, U.S. $
2. Cost of capital assets, U.S. $
3. The real value of the company, U.S. $

* Mikhail A. Nazarov, associate Professor of Samara State University of Economics; Olga V. Wagner , assistant of Samara State Technical University. E-mail: tp@sseu.ru.

Indicators needed for the analysis of sustainability on the goal

Parameter	Designation	Distribution method	Expected value	Average deviation
Output of oil, t	Q_1	logarithmically normal	263176	0,137
Output of gas, m^3	Q_2	logarithmically normal	9500000000	0,214
Cost of 1 t of oil, rubles	P_1	normal	8200	124
Price of 1 t of gas, rubles	P_2	normal	181,89	21
Cost of 1 t of oil, rubles	C_1	normal	730,20	162
Cost of 1 t of gas, rubles	C_2	normal	130	16,5
Production costs, mil. rubles	E	conditionally constant value	250	

4. The coefficient of equipment update

5. The cost of fixed assets, imposed in the current year, U.S. $

6. Probability of oil, gas and condensate (million barrels of oil equivalent)

7. Crude oil, including gas condensate, t

8. The level of profitability, %

9. The deterioration of the fixed assets, %

Characteristics of the 2nd -level

10. The number of labor TDI, hours

11. The number of labor-skilled workers, hours

12. The number of labor management, hours

13. Percentage of staff with a degree in science, %

14. The percentage of employees in R&D activity, %

15. The amount of casual labor, hours

Characteristics of the 3rd level

16. The value of intangible assets, U.S. $

17. Effective rate, U.S. $

18. The availability of communication resources, U.S. $

19. The coefficient of update equipment

20. The costs for all the types of research and scientific innovation, , U.S. $

21. Production and operating costs of oil production, U.S. $

22. The relative volume of exported R&D, U.S. $

23. The relative volume of sales of inventions licenses

24. Goodwill

For these characteristics integral data from 6 Russian oil companies was collected during the period from 2004 to 2008. According to the available data α_t parameters were calculated. Some data needed to calculate the stability analysis are presented in table.

The financial result shall be deemed equal to:

$$FR = Q_1(p_1 - c_1) + Q_2(p_2 - c_2) - E$$

Then the sustainability on the goal is calculated as:

$$P(FR \geq 500) = \int_0^\infty f(Q_2)\int_0^\infty f(p_2)\int_0^\infty f(c_2)\int_0^\infty f(p_1)$$

$$\int_0^\infty f(c_1)\int_{\frac{400+E-Q_2(p_2-c_2)}{p_1-c_1}}^\infty f(Q_1)dQ_1dc_1dp_1dc_2dp_2dQ_2$$

and in this case, the sustainability on the goal will be 0,441, i.e. with the given initial data the company can achieve the financial result of more than 400 million dollars with the probability of 0,441. This value corresponds to the importance of sustainability innovation potential equal to 0,531.

Attempting to find a correlation between the innovative potential and sustainability on the goal led to the following conclusions:

1. The relationship between the innovative potential and the sustainability on the goal is not of monotonous nature.

2. The relationship between the focus on the objective and the innovative opportunities can be monotonically decreasing if no changes affect the importance of the sustainability on the goal.

3. In managing the efficiency of resources there should be the requirement to combine maximum efficiency with a number of limitations as a controlling parameter.

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