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ASSESSMENT OF INNOVATIONS EFFECTIVENESS IN THE MANUFACTURING INDUSTRY OF KAZAKHSTAN

This article assesses the effectiveness of innovations in the manufacturing industry of Kazakhstan. Currently there are no indicators for innovative capacity in the domestic practice, to characterize its efficiency. The authors propose to supplement the existing system of innovations performance assessment with the return indicator. The research findings demonstrate that the return of innovations implemented in manufacturing is usually very low, that is innovative activity is inefficient.

Keywords: *innovative potential; innovation return; innovative capacity; innovation income; innovation efficiency.*

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ОЦІНЮВАННЯ ЕФЕКТИВНОСТІ ВИКОРИСТАННІ ІННОВАЦІЙ В ОБРОБНІЙ ПРОМИСЛОВОСТІ КАЗАХСТАНУ

У статті оцінено ефективність використання інновацій в обробній промисловості Казахстану. У результаті аналізу виявлено, що у вітчизняній практиці оцінювання інноваційного потенціалу відсутні показники, які б характеризували ефективність. Тому запропоновано доповнити чинну систему оцінювання результатів використання інновацій показником їх віддачі. Результати довели, що в обробній промисловості Казахстану віддача від впроваджених інновацій дуже низька, а це свідчить про їх неефективність.

Ключові слова: *інноваційний потенціал; інноваційна віддача; інноваційна ємність; інноваційний підхід; ефективність використання інновацій.*
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ОЦЕНКА ЭФФЕКТИВНОСТИ ИСПОЛЬЗОВАНИЯ ИННОВАЦИЙ В ОБРАБАТЫВАЮЩЕЙ ПРОМЫШЛЕННОСТИ КАЗАХСТАНА

В статье дана оценка эффективности использования инноваций в обрабатывающей промышленности Казахстана. В результате анализа выявлено, что в отечественной практике оценки инновационного потенциала отсутствуют показатели, характеризующие его эффективность. Поэтому предложено дополнить действующую систему оценки результатов использования инноваций показателями их отдачи. Результаты показали, что в обрабатывающей промышленности Казахстана отдача от внедренных инноваций очень низкая, что свидетельствует об их неэффективности.

Ключевые слова: *инновационный потенциал; инновационная отдача; инновационная емкость; инновационный доход; эффективность использования инноваций.*

Problem statement. Today it is quite difficult to analyze the efficiency of innovations in the manufacturing industry of Kazakhstan. Thus, the Committee on Statistics of the Republic of Kazakhstan carries out monitoring of science and innovation state, but does not assess the return of the resources invested in innovations. This is because there is still no single method to assess innovations' efficiency. For example, there are only indicators of resources use in the "science" section, in the "innovation" section – the indicators concern only financial and informational

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resources use (Committee on Statistics, 2015). Thus, there is a need to supplement and clarify the existing method in terms of innovations efficiency.

Recent research and publications analysis. There are different approaches to assessment of innovations efficiency in an economic system, in which its innovative potential is of paramount importance. It is the whole complex of institutional, intellectual, financial, scientific, technical and information resources, the action vector of which is aimed at increasing and improving quality (Karpitskaya et al., 2006; Kiselev, 2001; Romanova et al., 2013; Reshetnikov, 2004; Tahir, 2012). Each author formulates his/her own approach to understanding of "innovative potential". J. Bright (1968), P. Druker (2007), J. Schumpeter (1982) interpret this concept depending on the subject and the scope of their research, but the analysis of these different definitions leads to the conclusion that the main function of innovation is modification. J.H. Felix (1998) having studied the activity of small and medium-size companies, associated their success directly with innovations. H. Van de Ven Andrew and S.P. Marshall (1990) considered the methods used to study the processes of innovative development. These methods are applicable to other studies too.

The research objective is to improve the assessment methods when it comes to efficiency of innovative activity of enterprises in the manufacturing industry of Kazakhstan.

Key research findings. The following groups of indicators can be singled out in the assessment of innovation level of an economic system:

- innovation performance indicator;
- indicators of innovation cost;
- indicators, associated costs and results from innovation.

Innovative potential should be understood not only as the whole complex of resources that form a single system, but also as an organizational mechanism. Appropriate institutional environment is required for implementation of new knowledge into innovations.

Based on the definition of innovative potential and the existing methodological approaches, we propose to supplement the system of indicators of the results from innovations by such indicators as:

- the share of innovative products in the aggregate industrial output and its dynamics;
- the share of costs for technological innovation in the volume of innovative products.

Today there is no separate accounting record of enterprises' operating costs related to innovation process in the domestic practice. However, the cost structure itself can also be used as an important indicator. Cost and innovation performance indicators are the basis in determining the innovation level. In general, effectiveness of innovative development can be calculated as the ratio of innovation result to costs.

The proposed computation methodology is based on the existing methodology of effectiveness's estimation of the use from production factors. Thus, the resumptive indicator of the resources effectiveness is based on the principle of commensuration of the produced products' volume and the cost of the resources used. For example, in order to characterize the effectiveness of the fixed assets use, the indicators of capital productivity and capital-output ratio are used, while for the description of material

resources' use material productivity and material consumption indicators are used (Gorfinkel, Shvandar, 2007).

In our opinion, the following derivative indicators can be introduced to assess the efficiency of innovations in manufacturing:

- innovation return;
- innovative capacity;
- innovation income;
- the share of innovation factor in the growth of industrial output;
- the overall index of innovation efficiency considering changes in the output and labor productivity.

Innovation return characterizes the volume of products manufactured by an enterprise per 1 tenge (KZT) of costs spent on technological innovation and is calculated by the formula:

$$G = Y / Q, \tag{1}$$

where G – innovation return; Y – industrial output, mln KZT; Q – costs of technological innovation, mln KZT.

Innovative capacity of a manufactured product is defined as the reverse index of innovation return. It characterizes the amount of costs on technological innovation per 1 KZT of industrial output:

$$E = Q / Y. \tag{2}$$

The innovation return and innovative capacity are the indicators, which can be used to determine the level of innovation. Increase or reduction of innovative capacity characterizes the result of innovative activity in the form of savings or costs of technological innovations.

Innovation income per one full-time worker is determined as the ratio of volume of innovative products sold in the manufacturing income from products sold per the number of staff of core activity of the industry.

$$D = (Y_{IO} - Q) / P, \tag{3}$$

where D – innovation income per one worker of core activity, KZT/person; Y_{IO} – industrial output, mln KZT; Q – costs of technological innovations, mln KZT; P – the number of staff engaged in core activity, persons.

These figures cannot be considered as the criteria of the effective use of innovations. To assess the efficiency of costs, it is necessary to compare the innovation return or capacity calculated for a certain period with the data of the previous period.

The level of innovation depends on the ratio of growth rate of costs for technological innovation and the cost of industrial products. Under outstripping growth rate of manufactured industrial products the efficiency of innovation is growing, and under outstripping growth of technological innovations costs it is reducing. Thus, we introduce such criterion of the innovative activity efficiency in the industry as the share of innovation factor in industrial production output:

$$f = \frac{\left[Y_2 - (Q_2 \times G_1)\right]}{Y_2 - Y_1}, \tag{4}$$

Table 1. **Performance indicators of innovation in the manufacturing industry of Kazakhstan,** *calculated by the authors using the data of the* (Committee on Statistics. Science and Innovations: Basic Indicators for 2003–2014)

Indicators	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Innovation return	126.60	137.86	163.58	150.52	454.18	55.13	93.74	100.09	81.38	74.59
Innovative capacity	0.008	0.007	0.006	0.007	0.002	0.009	0.006	0.01	0.0129	0.013
Innovation income per 1 worker in the industry, KZT/person	5312.0	6639.3	7876.6	8880.3	8552.5	11165.1	13685.4	15948.9	16823.9	17979.4
The share of innovations in the gain of industrial output	-	0.36	0.86	-0.70	-4.76	-30.97	2.07	0.54	-3.32	-2.31

where Q_2 – costs for technological innovation in the reporting year, mln KZT; G_1 – Innovation return in the basic year; Y_1 and Y_2 – industrial output in the basic and the reporting year respectively, mln KZT.

The calculation results are summarized in Table 1.

The analysis of innovations efficiency in manufacturing shows that during the period from 2010 to 2014 the innovation return reduced in comparison with the period of 2005–2009. Thus, innovation return increased from 126.6 KZT in 2005 to 454.18 KZT in 2009, then decreased down to 74.59 in 2014. The share of innovations in the industrial production gain is quite low, and in some periods it even has a negative value.

Conclusions. The use of the proposed technique for assessment of the innovative activity effectiveness allows us determining the innovation return in the industry and its share in production volumes. The analysis demonstrates that innovations efficiency in manufacturing of Kazakhstan is too low to exercise any significant impact on its development.

Thus, it is necessary to increase dramatically the amount of financing for technological innovations that will allow enhancing the level of return per innovation and this, in turn, will significantly impact the general development level of the manufacturing industry in Kazakhstan.

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