

Analytical assessment of the economic efficiency of innovations in the field of agro-industrial complex

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Abstract. Significant financial resources are invested in the innovative economic development in all countries of the world. At the present stage of development of the Russian Federation, there is a complex of problems hindering the introduction of innovations in the activities of most sectors of the national economy of Russia. The modern methodology for evaluating the efficiency of investments does not take into account the innovative component, and the calculation of efficiency is carried out by the "boiler" method, where it is difficult to identify the role and significance of innovations in increasing the effect of investment activity. To solve this problem, it is proposed to identify and evaluate the efficiency of innovations and their profitability, separately from the integral investment costs by analytical decomposition of investment profitability parameters. The proposed algorithm allows to explore not only the quantitative side of investments and their volumes, but also evaluate the quality of the investment project, explore and analyse the cost structure, its qualitative characteristics, and identify the most effective investment and innovation costs.

1 Introduction

Innovative activity is inextricably linked and is an integral element of investment activity. It is the size of investment costs in innovation that determines the degree of significance and depth of development of an innovative activity, its relevance to the national economy and society. Taking into account the fact that significant financial resources are invested in innovation in all the advanced countries of the world, the return on this area of financial investment should be high, or the money spent should be repaid by the output of innovative products. The problems and key areas of economic efficiency of production in many countries of the world, including innovations, are discussed in works of some foreign researchers [1, 2, 3]. Native scientists believe that the growth in the efficiency of most sectors of the national economy, especially its manufacturing sector, is based on investment, innovation and digital transformation [4-13]. These studies allow to conclude that innovations contribute to the growth of labor productivity [14-18]. There is an opinion that a large role in strengthening the country's food security and supporting the

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innovative vector of development is assigned to the state [19]. Currently, there is a complex of problems hindering the introduction of innovations in the activities of key areas and sectors of the national economy of Russia. They are especially relevant in the agricultural sector, where, based on many years of experience in many countries of the world that develop this area of material production on the basis of an innovative vector, one can conclude that they are very efficient and useful for the industry.

2 Materials and methods

Innovations in Russia are introduced into the agrarian sphere of activity very difficult and contradictory, they face a complex of problems, primarily related to the specifics of agricultural production. We have to state the fact that at present there is no active innovative activity in the agro- industrial complex and it is limited only to individual areas, for example, only technical and technological renewal, and in a very narrow aspect. There is a whole range of factors hindering innovative activity in agriculture. The whole variety of factors creating problems for active innovation in the key production area of the national economy can be systematized and formalized in the following blocks: financial, regulatory (organizational), personal (Table 1).

Table 1. Systematization of factors that have a key effect on the innovative activity of enterprises (organizations) of the agricultural sector of the national economy.

Deterrent	Characteristics of the problem
Financial	<ol style="list-style-type: none"> 1. Limitation of the investor's own resources for investing in an innovative development. 2. Weak or complete lack of state support for the innovative activity of the enterprise (organization) of the agro-industrial complex. 3. The absence of a financial mechanism for stimulating innovation at all levels of government and industry management.
Regulatory (organizational)	<ol style="list-style-type: none"> 1. Insufficient elaboration or lack of an efficient legal mechanism aimed at the interest and (organizational) implementation of an innovative strategy for the development of the industry. 2. The absence of regional legal acts activating and stimulating the development of innovative activities of enterprises (organizations) of the industry.
Personal	<ol style="list-style-type: none"> 1. Insufficiency of managerial human resources' understanding of the importance and relevance of comprehensive support for the innovative vector of development of the agrarian sector of the national economy acting through organizations (enterprises). 2. The low level of understanding of the middle and lower managerial human resources of enterprises (organizations) of the role and importance of innovations in the growth of production efficiency. 3. Psychological disqualification of managers for high financial costs for innovation at the expense of enterprises (organizations) own funds.

The presented list is far from exhaustive, it can and will be supplemented and enriched with new criteria and factors that arise and will arise in the future in the process of organizing, implementing and promoting innovative activities at enterprises in the agro-industrial complex. However, the current level of advancement of innovations in the sphere of material production and agriculture, in particular, is determined by the above key deterrents. As a rule, the evaluation of innovative activity efficiency is based on comparing the result of investments in this area with the costs of innovation, similar to the algorithm for evaluating the efficiency of investment activity. The results of the evaluation, as a rule,

are expressed in a relative parameter - the level of profitability, which is determined as a percentage. The higher this parameter is, the more efficient and effective the spending on innovation. Due to the fact that innovation is one of the areas of investment activity, the evaluation of the efficiency of investment costs should be carried out taking into account the innovative contribution to the synergistic effect. Usually, the efficiency of investments is manifested in the level of return on investment, expressed as a percentage. The modern methodology for evaluating the efficiency of investments, as well as capital investments, does not take into account the innovative component, and the evaluation of efficiency is carried out by the "boiler" method, where it is difficult to identify the role and significance of innovations in increasing the effect of investment activity. To solve this problem and achieve these goals, it is proposed to identify and evaluate the efficiency of innovative investments, their profitability, separately from the total investment costs allocated to investment projects, highlighting the net investment costs and the costs of innovation as an independent parameter, applying the methodology (algorithm) for evaluating the efficiency of investments, presented by formula 1.

$$E(p) i = (P (I) / C \text{ net} + C \text{ in}) \times 100 \% \tag{1}$$

where $E(p) i$ is economic efficiency (profitability) of investments, % $P (I)$ is profit (income) received as a result of investment activities, $C \text{ net}$ is net investment costs (net investments), million rubles,

$C \text{ in}$ is innovation costs, million rubles.

In this case, highlighting the amount of innovation costs as an independent parameter, one can determine the degree of significance of innovations, including their numerical value (contribution) in the formation of the final parameter of the economic efficiency of investments ($E(p) i$). Such an algorithm allows, with a high degree of accuracy and reliability, to identify the level of efficiency of both investment and innovation costs, and an analysis of the dynamics of innovation investments will allow specialists in this field of knowledge to draw relevant conclusions and practical recommendations, to identify promising key areas of effective investment and innovation. Analyzing the time series of parameters of investment efficiency and innovative costs, investment specialists can identify bottlenecks in investment and innovation activity, stimulating or slowing down investment and innovation activity. To identify the quantitative effect of the above parameters on the efficiency of investments, it is advisable to conduct a factor analysis of investment activity with the determination of the influence of each factor on the performance indicator. In order to evaluate the efficiency of investment projects objectively, the impact of costs on innovation in investment, it is proposed to conduct an analytical evaluation of the efficiency of investment costs with a mathematical calculation of the effect on the level of profitability of innovation costs. As an example, it is proposed to evaluate three investment projects for the feasibility of their implementation in the agro-industrial complex, identify the role and significance of the innovative component in these projects and draw appropriate conclusions about the feasibility of their implementation, based on the initial parameters of analytical table 2.

Table 2. Initial data for analytical evaluation of the efficiency of investment projects in the field of agro-industrial complex in order to determine the possibility of their implementation.

Parameter	Investment project No. 1	Investment project No. 2	Investment project No. 3
Total investment costs for implementation and development of the project, million rubles	136.7	189.9	156.8
including spending on innovations, mln.	48.6	87.1	54.3

The share of innovation costs in the total amount of investments, %	35.5	45.9	34.6
Planned total profit (income) from investment activities (total income from investments during the entire period of operation), mln.	199.4	282.8	193.8
Economic efficiency of the investment project, %	145.9	148.9	123.4

Analytical table 1 shows that, having three investment projects with different initial investment parameters, innovation costs and predicted profitability, one should evaluate their efficiency and identify priority projects, based on the proposed algorithm to calculate the efficiency of investment projects. Moreover, an important aspect of these calculations will be the evaluation of the efficiency and the role of innovation costs in it. This table also presents the economic efficiency of projects for three options of investment costs according to the algorithm of formula 1. Thus, according to the calculations, based on the criterion of investment efficiency, investment project No. 2 with a profitability of 148.9% is recognized as the most effective one. The specified project is most likely to be accepted for implementation, which means that its future efficiency should be evaluated. A deeperevaluation of the investment quality requires analyses of the investment costs' structure, including the costs of innovation, determining their share and degree of influence on the integral parameter of investment efficiency. Table 3 presents the initial parameters of the total investment costs, as well as net investment costs and innovation costs by years during the entire period of implementation of the adopted project, planned profit.

Table 3. Investment costs by years of the project implementation and their efficiency, million rubles.

Parameter	2017	2018	2019	2020	2021	Total investment costs
Investment costs for the project implementation and development by years	52.0	44.5	48.7	25.5	19.2	189.9
Index of change (basic)	1.00	0.86	0.93	0.49	0.37	-0.63
including net investment costs by years of the project implementation	24.5	21.6	22.5	18.2	16.0	102.8
Index of change (basic)	1.00	0.88	0.92	0.74	0.65	-0.35
innovation costs by years of the project implementation	27.5	22.9	26.2	7.3	3.2	87.1
Index of change (basic)	1.00	0.83	0.95	0.27	0.12	-0.88
The planned profit (income) from investment activity (cumulative income from investments during the entire period of operation and by years of development), mln. rub.	36.5	48.9	61.4	64.0	72.3	282.8
Index of change (basic)	1.00	1.34	1.68	1.75	1.99	+0.99

When evaluating the efficiency of an investment project with innovative costs, it should be noted that over the years of the project implementation, all costs tend to decrease. This statement applies to both net investment costs and innovation costs. Nevertheless, despite the dynamics of their decline over the years, the total costs in all areas of investment remain within the projected ones. It is important to mention that there is a stable and sustainable growth dynamics of profits from the implementation of the project by years of investment. This trend is quite relevant, given that investment costs have a prolonged economic effect and over the years have the opportunity and ability to grow. In this case, such a trend and dynamics in terms of profitability is present, which indicates the efficiency of the selected project.

3 Results and discussion

When determining the efficiency of investment costs, an important place in this study is given to the differentiation of investments by the purpose and quality. In particular, the effect of investments should be evaluated by dividing them into net investment costs and innovation costs. In this case, it is quite realistic to determine and numerically identify the effect of these investments on the final result, namely, on the profitability of the investment project. From this point of view, an analytical evaluation of investments using the proposed algorithm is quite acceptable and applicable to evaluate the efficiency of investment costs, differentiated by two key positions: net investment costs and innovation costs. The algorithm for solving the problem is presented by the data of analytical table 4.

Table 4. Analytical evaluation of the effect of key factors on the economic efficiency of an investment project.

Parameter	Base period (2017)	Fiscal period (2021)	Deviation
Total investment costs for the project implementation and development by years	52.0	19.2	-32.8
Including net investment costs	24.5	16.0	-8.5
innovation costs	27.5	3.2	-24.3
Planned profit (income) from investment activities (total income from investments during the entire period of operation and by years of development), mln. rub.	36.5	72.3	+35.8
Economic efficiency (profitability) of the investment project, %	70.1	376.6	+306.5
General deviation of the parameter of efficiency (profitability) of an innovative project, %		+306.5	
including through 1) the influence of parameter "net investment costs", %		+13.8	
2) the influence of parameter "costs of innovation", %		+106.2	

3) the effect of parameter “planned profit (income) from investment activities (cumulative income from investments during the entire period of operation and by years of development), %		+186.5	
Parameter identification	13.8+106.2+186.5=306.5; 306.5=306.5 (corresponds)		

When evaluating the efficiency (profitability) of an investment project in the first and last year of development by the method of analytical decomposition, it could be concluded that it was influenced by such key factors as net investment costs, innovative costs and profit (income) from investment activities. Their numerical influence was revealed in the process of analytical decomposition of the initial parameters for evaluating the efficiency (profitability) of investments. As a result of that decomposition, it was determined that the investment project was very efficient and its profitability was 376.6 % in the last (2021) year of its implementation. An important role in that final result was assigned to factors whose numerical value and influence should be determined in the manner indicated above, i.e. the method of analytical decomposition of the resulting parameter into its components. In that case, the cumulative increase in project profitability over the five-year period (2017-2021) amounted to +306.5 % (376.6 %-70.1 %). An analytical decomposition of that parameter allowed to determine the effect of key factors on that increase. As a result of the study, it was determined that parameter “net investment costs” had an effect on the growth of the efficiency (profitability) of the investment project at the level of 13.8 percentage points, parameter “innovation costs” ensured an increase in profitability at the level of 106.2 percentage points and parameter “planned profit (income) from investment activities” ensured an increase in profitability at the level of 186.5 percentage points. Taken together, all the above parameters ensured an integral increase in profitability by 306.5 percentage points. If the indicated degrees of participation in the growth were expressed as a percentage, based on 100 % parameter, the structure of parameters by the share of effect was 4.5 %, 34.7 % and 60.6 %, respectively. Thus, based on the analytical decomposition of the initial parameters, the effect of each of those parameters on the final effect of investments was determined as well as the degree of participation of each one in the formation of the final parameter. It should be noted that in that case, it was the innovation costs that gave a significant increase in the economic effect in the form of an increase in profitability by 106.2 percentage points with an effect level of 34.7%, which meant that in the future the investment process should be based on an increase in innovation investments, which would give investors a greater effect of investment costs compared to net investment.

4 Conclusion

Thus, this calculation presents and mathematically proves the key role of innovation in the investment process. The proposed algorithm makes it possible to evaluate not only the quantitative side of investments, their sizes and volumes, but also to study the quality of the investment project, to investigate and analyse the cost structure and its qualitative characteristics, to identify the most effective investment costs, to focus on them in the present and future investment activities, which allows to enhance the effect of investments significantly and provide additional benefits to investors and all legal entities and individuals interested in the investment process.

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