
Methodological bases for assessing the level of innovative development of agriculture and its service infrastructure activities

SAYYORA NASIMOVNA KHAMRAEVA¹, MUNISA YULCHIYEVNA ALIMOVA²

¹Head of the Chair “Innovative Economics” at Karshi Engineering-Economics Institute, Doctor of Economics

²Assistant teacher at the Chair “Innovative Economics” at Karshi Engineering-Economics Institute

Abstract: The article examines methods for assessing the level of innovative development of agriculture and its service infrastructure sectors. In the process of development, the innovative development of the infrastructure that serves it is scientifically justified. Uzbekistan has developed a conceptual model for the formation and development of innovative infrastructure in the agricultural sector, taking into account the conditions and factors of innovation policy. The effectiveness of innovative infrastructure in agriculture is considered in terms of strategic, economic, and social effectiveness, from the point of view of state and territorial authorities, economic entities in agriculture, and entities receiving innovative infrastructure. The methodology for determining the impact of innovative development of agriculture and its service infrastructure on efficiency has also been improved.

Keywords: agricultural infrastructure, agriculture, innovation, effectiveness, index, efficiency.

INTRODUCTION

In the innovative development of the infrastructure network, of course, it is necessary to have detailed information about its actual state of development, development trends compared to previous years and the level of provision. In general, the concept of "assessment" implies a consideration of its social, economic and other indicators, based on the goals and objectives of the system being evaluated. Performance indicators can be evaluated by the infrastructure complex through its own systems (internal evaluation) and by other institutional enterprises (external evaluation), depending on the purpose.

Indicators for assessing the level of innovative development of agricultural infrastructure are based on indicators that reflect the characteristics of quantity and quality. The collection and processing of quantitative indicators is somewhat complex, but is important in evaluating efficiency. Methods such as statistical reporting and questionnaires can be used to collect quantitative indicators, and methods such as economic-mathematical, statistical, monographic, experimental, computational and modeling can be used to process this data.

Quality indicators can be collected through a formatted interview and questionnaire. These data reflect the status of business entities, their relationships and decision-making mechanisms.

Assessing the effectiveness of innovative development of infrastructure in the agricultural sector is a new direction. In the course of the research, the main directions of assessing the efficiency of the infrastructure network in general were identified. As a result of scientific substantiation of this issue, a reliable mechanism for attracting investment in the infrastructure network will be established and will serve to develop an optimal solution for its development.

LITERATURE REVIEW

Currently, there are different approaches to assessing the effectiveness of infrastructure development. While some economists have proposed an assessment of the capacity of the infrastructure sector, some other economists have suggested an assessment of income and the level of employment [V.F. Stukach, 2003], other economists in their research [V.N. Stakhanov, 1989] proposed to determine the overall economic efficiency of the infrastructure network by the ratio of the sum of efficiency of the infrastructure system and beyond to the sum of losses and costs caused by poor quality of infrastructure activities.

M.Oripov [M.A.Oripov, 2007] in his research work in determining the efficiency of infrastructure to express the volume of infrastructure services in terms of growth rates of gross domestic product or gross product, as well as proposed to assess the level of infrastructure development by gross output (or product sales) when all factors are constant (const) and by an index of the volume of infrastructure services provided.

B.T.Salimov and N.I.Urakov note that “the main indicator of economic efficiency of production infrastructure is the self-recovery of production costs at facilities.” [B.T.Salimov, N.I.Urakov, 2003]

This calculation method cannot serve as a practical tool for evaluating the innovative development of agricultural service infrastructure. The complexity of this calculation method can be used to assess the damage

caused by extra-system efficiency and low quality of service. Infrastructure services are an integral part of the overall reproduction process, and the separation of efficiency and cost from gross domestic product is impossible.

It is also expedient to classify the indicators of economic efficiency on a hierarchical level (macro-, meso-, micro-), which allows to estimate the income from the level at which expenditures were made [E.E.Mojaev, A.E.Mojaev, A.A.Abramov, 2014].

Such an approach is more complicated when assessing the cost-effectiveness of innovative development of the infrastructure network, taking into account its specific features.

First, the labor of infrastructure network workers does not always lead to an increase in the final product.

Second, the operation of the infrastructure network usually leads to cost savings, resource savings, loss reduction, and so on.

Therefore, in theory and practice, there are different approaches to assessing the effectiveness of an infrastructure network.

OBTAINED RESULTS

Different methods are used to assess the effectiveness of investments in infrastructure development. The cost-benefit method is widely used abroad.

Its essence is to substantiate the efficiency of investments and the impact of the country on economic growth, taking into account the system of social and economic indicators that characterize the results of investment activities. The advantage of this method is that it can be analyzed not only at the micro level, ie on the example of a separate enterprise, but also at the macroeconomic level of investments in infrastructure on the basis of large-scale programs.

In assessing the effectiveness of innovative development of agricultural infrastructure, attention should be paid to the following aspects:

- mutual proportional distribution of investments made for the purpose of development of infrastructure and production sector providing services to agriculture;
- specific features of the organization of infrastructure facilities serving agriculture;
- sources and scale of available and expected costs if infrastructure facilities are not sufficiently developed.

Taking into account the above points, the level at which the infrastructure should be available and innovative development will be determined.

Indicators and criteria for assessing the innovative development of infrastructure providing services to agriculture in modern economic conditions should meet the following requirements:

- these indicators and criteria should fully reflect the tasks performed by the agricultural infrastructure sector;
- The system of indicators should clearly show the process of introduction of innovative developments, transfer technologies in the industry;
- evaluation indicators and criteria should reflect its impact on the final product as a result of innovative development of infrastructure;
- these criteria should clearly identify and assess the contribution of each entity in the infrastructure to the final result of the activity, ie each subdivision should be responsible for the performance of its functions;
- Evaluation indicators should encourage the efficient and quality performance of the tasks and services performed by the infrastructure.

We propose to develop and calculate the value of single indices, taking into account the above requirements and the complexity of assessing the innovative development of infrastructure serving agriculture.

The index of assessment of innovative development of infrastructure serving the agricultural sector in terms of content reflects the ability to perform the tasks assigned to the innovation sector, ie the creation, development and dissemination of various innovations, the implementation of innovative activities. The index should also reflect the level of consumers' purchase and use of news and innovations.

To calculate a single index for evaluating the innovative development of infrastructure serving agriculture, we propose to first identify 3 subindexes that characterize it.

The first one is the indexes which consists of the following indicators is the innovation opportunity index (I_i), which represents the state, capacity and resources of intellectual and organizational resources, labor, information and financial resources (number of studies - (K_t), research (S_t) and development (S_i), the availability of patents (P_s):

$$I_i = K_t + S_t + S_i + P_s / 4 \quad (1)$$

The second one is the consumer demand for innovation index (I_{id}), an index of indicators that reflects the level of readiness of consumers to purchase intellectual products and use them in business (agricultural infrastructure

(F_i) and the financial condition of agricultural entities (F_{qx}), the level of qualification of specialists(M_d), the availability and use of intangible assets in enterprises(A_d):

$$I_{td} = F_i + F_{qx} + M_d + A_d/4 \quad (2)$$

The third one is the structural index (I_t) represents the level of integration and efficiency of tasks performed using elements of innovative infrastructure in the process of innovative development of agricultural infrastructure (number of innovative infrastructure enterprises K_s , the share of enterprises engaged in innovative activities in total infrastructure facilities K_u ; net profit from the implementation of innovative projects SF):

$$I_t = K_s + K_u + SF/3 \quad (3)$$

The single index of a region is calculated as the arithmetic mean of the individual indices. In turn, each index is represented by a group of indicators. The peculiarity of these indices is that the results obtained for each region are compared with the corresponding indices or normative values for the average republic. If a certain index calculated by region has a value of one or more, it means that the region is above the national average or normative indicators, and vice versa, lags behind the republican or normative indicators.

It is known that agricultural infrastructure directly and indirectly affects the development of agro-industrial complex, ie as a result of innovative development of agricultural infrastructure has a positive impact not only on the infrastructure itself, but also on economic efficiency of agricultural production, storage and processing. also changes.

Additional benefits are one of the key indicators in determining the cost-effectiveness of innovations. Profit is an indicator of value, so in the analysis of the dynamics of profit it is advisable to take into account the impact of inflationary factors on changes in its quantity. To do this, revenue is adjusted by the average index of growth of average product prices by industry, and costs are reduced by the amount of their growth as a result of an increase in resource consumption prices for the products sold in the analyzed period.

For a more detailed analysis of innovations, profitability indicators that characterize the overall performance of the enterprise are identified, as the profitability of activities in different areas is very important. The need for profitability indicators is that these indicators describe the final results of economic entities more accurately, showing the ratio of the efficiency of pre-planned or used resources.

For a more thorough analysis of the effectiveness of innovations, it is proposed to take into account the following two indicators, which are not included in the above system of indicators: the competitiveness of innovative projects and the assessment of patents, licenses. The need for these indicators is explained by the fact that agricultural production is entering the market relations, as well as increasing competition in the market of agricultural products. The first of the indicators allows to assess the competitiveness of manufactured products, the second - to assess the cost-effectiveness of a new type of patented product.

In the context of economic liberalization, not only the management and financing of innovative activities, but also the increase in economic efficiency resulting from their development is important. In this regard, one of the main tasks is to determine the cost-effectiveness of the implementation of innovations in agricultural production. Given the structural changes in the economy, it is advisable to approach the objective requirements, which also cover the factors of scientific and technological progress, to carry out such an analysis. This situation demonstrates the need for a radical change in economic relations, the use of new theoretical and practical methods to determine the economic efficiency of the development of research and development.

The calculation of the cost-effectiveness of the development of scientific developments depends on a number of factors: types of scientific and technical products, scope, stages of scientific and technical work, the level of costs of innovation, analysis of implementation results and et cetera.

DISCUSSION

The study analyzed the impact of the state, the agricultural sector and agricultural producers (farmers and dehkan farms) on the development of innovative infrastructure in the agricultural sector.

In our opinion, given that the development of any activity in society is formed on the basis of economic interests, it is justified in terms of strategic, social and economic benefits to be seen by the four entities: state and territorial authorities (government), agricultural entities (farms and dehkan farms, consumers of innovative infrastructure services) and innovative infrastructure facilities as a result of the development of innovative infrastructure. (Table 1).

Table 1: Types of benefits derived from the activities of innovative infrastructure in agriculture(Based on the author's researches.)

Beneficiaries	Types of benefits		
	Strategic	Economic	Social

State and territorial authorities	<ul style="list-style-type: none"> - volume of innovative products; - The share of innovative products in GDP and GRP; - total number of innovative enterprises; - number of patents and inventions; - development of innovative economy 	<ul style="list-style-type: none"> - the volume of products produced by innovative enterprises using innovative infrastructure; - the effectiveness of projects supported by state and regional authorities; - efficiency of attracted investments; - the effectiveness of research and development - the share of the state in research and development; - the amount of taxes paid to the state and local budgets 	<ul style="list-style-type: none"> - number of new jobs created; - the number of talented students, researchers, senior researchers and professors of universities engaged in innovative entrepreneurship in the agricultural sector
Agiculture	<ul style="list-style-type: none"> - volume and share of innovative products in the gross agricultural output; - growth of gross agricultural output; - network profitability 	<ul style="list-style-type: none"> - diversification of production; - integration of the agricultural sector and production 	<ul style="list-style-type: none"> - creation of new jobs; - increase in living standards in rural areas- creation of new jobs; - increase in living standards in rural areas
Business entities in agriculture	<ul style="list-style-type: none"> - increase in the volume of the market of agricultural products; - production growth; - profitability growth of the enterprise (profitability level) 	<ul style="list-style-type: none"> - level of expenses; - access to investments 	<ul style="list-style-type: none"> - consumer satisfaction with innovative infrastructure services; - satisfaction of agricultural entities with innovative infrastructure services
Innovative infrastructure facilities	<ul style="list-style-type: none"> - number of innovative infrastructure facilities, etc. newly established and those that have been operating for several years; - number of sold and implemented developments; - quality and demand for innovative infrastructure services; 	<ul style="list-style-type: none"> - volume of involved extra-budgetary investments; - efficiency (level of profitability); - payback period of involved investments 	<ul style="list-style-type: none"> - number of new jobs created; - share of talented students, researchers, senior researchers and professors of universities engaged in innovative entrepreneurship in agriculture; - average salary

The proposed evaluation system is universal and can be used to monitor the activities of various innovative infrastructure facilities.

The development of innovative infrastructure in agriculture will ensure the acceleration of innovation processes in the industry, the growth of innovative products and, ultimately, the stabilization of this industry. The main priority in the development of innovative infrastructure should be the introduction of high technologies in agriculture and the integration of science, education and highly developed production. Technoparks, innovation centers, business incubators and similar innovative organizations, which are the subjects of innovative infrastructure, are aimed at the use of modern resource-saving technologies in agriculture, the introduction of advanced innovations in competitive food production, animal husbandry, veterinary medicine and fodder production.

Thus, the implementation of innovative projects in agriculture will form new links between science, government and entrepreneurship, and the public-private partnership mechanism should be a tool to influence the development of innovative infrastructure in agriculture.

As a result of innovative development of agriculture and the infrastructure that serves it, production efficiency will increase. In order to accelerate this process, it is necessary to provide socio-economic conditions that encourage the use of new means of development and intensification.

The efficiency indicators used in the innovative development of agriculture and agricultural service infrastructure are characterized by their complexity in terms of interdependence.

A methodology for determining the impact of biological, technical, technological and organizational innovations on efficiency indicators in the innovative development of agriculture and infrastructure serving them has been developed (Table 2).

Table 2: Methodology for determining the impact of innovative development of agriculture and its service infrastructure on efficiency (1 Developed by the author's researches.)

Types of efficiency	Types of innovation	Obtained benefits		Indicators	Notes
		Agriculture	Livestock		
Economic	Biological	Improving productivity and improving product quality by increasing the genetic potential of plants and selection work	Increased productivity and improved product quality by increasing the genetic potential of livestock and improving the sensitivity of feed	$B_s = \frac{\Delta YaM}{I_m}$	<i>B_s</i> – efficiency obtained by increasing the genetic potential of plants (livestock) (introduction of biological innovations) ΔYaM – volume of additional agricultural (livestock) products received at the expense of biological innovations; <i>I_m</i> – Expenditures for increasing the genetic potential of plants, efficient use of high-yielding varieties, biotechnology, genetic engineering (improving the genetic potential of livestock, high-yielding livestock, biotechnology, genetic engineering)
				$B_{so} = \frac{\Delta YaM}{O_b}$	<i>B_{so}</i> – efficiency obtained by improving the nutrient base <i>O_b</i> - costs of improving feed quality and feed rations for livestock
				$K_{so} = \frac{O_h}{\Delta YaM}$	<i>K_{so}</i> - feed conversion factor, ie the amount of feed consumed per unit of output (1 kg of product growth, 1 kg of milk, 1 kg of wool, etc.); <i>O_h</i> - the amount of feed consumed; ΔYaM – volume of products from livestock
Economic	Technical and technological innovations	Increase in agricultural production due to material and technical resources spent on 1 hectare of arable land	Increase in livestock production due to material and technical resources spent on 1 conditional head of livestock	$I_t = \frac{\Delta YaM}{F_{as} + F_{ay}}$	<i>I_t</i> – technical and technological efficiency of agriculture (animal husbandry); ΔYaM – products obtained due to technical and technological re-equipment of agriculture (animal husbandry) (improvement of energy resources, introduction of innovative developments); <i>F_a</i> + <i>F_{ay}</i> – the cost of fixed and current assets spent on technical and technological re-equipment of the agricultural (animal husbandry) sector
				$T_e = \frac{\Delta YaM}{E_r}$	<i>T_e</i> – technical and technological efficiency due to the improvement of energy resources <i>E_r</i> - the cost of energy resources spent on technical and technological re-equipment of the agricultural (animal husbandry) sector
				$T_i = \frac{\Delta YaM}{I_{in}}$	<i>T_i</i> – technical and technological efficiency due to the introduction of innovative developments and projects (new varieties, modern methods of irrigation, artificial insemination, new breeds); <i>I_{in}</i> – investment in innovative developments

		Growth of commodity production in agriculture, reduction of terms of mastering and self-recovery of innovations, improvement of quality of agricultural products	Growth of commodity production in animal husbandry, reduction of innovation and self-recovery periods, improvement of quality of livestock products	$I_c = \frac{\Delta T}{I_{in}}$ $I_f = \frac{F}{I_{in}}$ $R = \frac{F}{I_{in}} * 100$ $M_u = \frac{\Delta Y a M}{V}$	I_t – cost-effectiveness derived from cost savings through innovation; ΔT – cost savings in product production as a result of innovation; I_{in} – expenditure on innovative developments (costs) I_f – economic efficiency due to increased profitability in the introduction of innovations; F – benefits obtained when introducing innovations R – profitability level of innovative activity, in percent M_u – labor productivity of innovative development; V – reduction of labor costs as a result of innovative activities
Social efficiency	Organizational innovations	Improving the quality of life of workers engaged in agriculture and the level of satisfaction of their various needs	Improving the quality of life of workers engaged in the livestock sector and the level of satisfaction of their various needs	$RID = (ND - ST) * Jpxq$	RID – real disposable income; ND – nominal income; ST – taxes, mandatory payments $Jpxq$ – the purchasing power index of money (the inverse of the price index).
				$PIH = (NIH - SA) * Jpxq$	RIH – real wages; NIH – nominal wages; SA – taxes, mandatory deductions from wages
Ecological and economic	Ecological innovations	Environmental protection, increase in the volume of eco-friendly products produced		$E_s = \frac{EM}{X}$	E_s – ecological efficiency; EM – the volume of eco-friendly products produced; X – the amount of expenses incurred in producing eco-friendly products

The efficiency indicators of innovative development of agriculture were systematized based on the type of efficiency obtained and compared with different costs.

In agriculture, the importance of biological innovation in the structure of productivity types is explained by the increase in the volume of products obtained as a result of increasing the genetic potential of plants and livestock, as well as the amount of feed consumed in animal husbandry.

The efficiency achieved due to technical and technological innovations is determined by the reduction of the capacity of the fund and energy resources per 1 hectare of arable land and 1 conventional livestock. This economic efficiency was also expressed by determining the volume (value) of products at the expense of funds spent on innovative developments for the technical and technological re-equipment of agriculture. The economic efficiency of innovative activity is determined by the achievement of additional income by improving the quality of resources and is expressed by indicators such as cost reduction, level of profitability and labor productivity.

The social efficiency of innovative activities reflects the living standards of the population and is determined by the increase in wages of those engaged in agriculture, the ratio of real incomes and subsistence minimums.

The ecological efficiency of innovative activity in agriculture is determined by the improvement of the environment, and to assess it, an indicator such as the growth of the volume of ecologically clean products produced at the expense of the total cost of one soum is used.

In general, agriculture and the infrastructure that serves it are influenced by many factors and are a complex indicator of the economic efficiency of facilities. Currently, cost-effectiveness indicators are used for a particular type of product, but determining the efficiency obtained as a result of innovative development of the whole industry is a number of complexities due to the different effects of different resources in the production process. Therefore, it is important to develop indicators that reflect the level of innovative development of the agricultural sector and the infrastructure that serves it.

It is expedient to apply economic-statistical and economic-mathematical methods to such indicators. Using the economic-statistical method allows to comprehensively assess the economic efficiency of innovative development on the basis of determining the relationship between various factors and production results, normative indicators of effective use of existing opportunities are determined on the basis of economic-mathematical optimization.

REFERENCES

1. Стукач В.Ф. Региональная инфраструктура АПК / В.Ф. Стукач. - Омск: Изд-во ОмГАУ, 2003. – 320 с.
2. Oripov M.A. Development of infrastructure services in agriculture of Uzbekistan. T.: Fan, 2007. – pp.45-61.
3. Salimov B.T., Uraikov N. Economics of infrastructure serving agriculture (textbook). –T.: TSEU, 2003. – p.19.
4. Стаханов В.Н. Экономика инфраструктуры общественного производства // В.Н. Стаханов. – Ростов н/Д, 1989, С 87.
5. Можяев Е.Е., Можяев А.Е., Абрамов А.А. Система показателей оценки уровня НТП в сельском хозяйстве// Актуальные проблемы гуманитарных и естественных наук.- Москва, 2014. № 4-1.- 249-254 стр.
6. Хамраева С. Н. Состояние инвестиционно-инновационного развития сельского хозяйства в Узбекистане //Economics. – 2020. – №. 1 (44).
7. Khamraeva S. N. The role of infrastructure in the socio-economic development of agriculture in the context of anti-crisis measures //Regional features of mitigating the effects of the global financial and economic crisis in Uzbekistan. Proceedings of the Republican scientific-practical conference.–Termez. – 2014. – С. 182-184.
8. Khamraeva S. N. Methodological foundations of innovative development of agricultural infrastructure //Journal of Management Value & Ethics. – 2018. – Т. 8. – №. 1. – С. 10-17.
9. Ushachev I. G. (Ed.), Trubilin I. T. (Ed.), Oglobin E. S. (Ed.), Sandu I. S. (Ed.) (2007). Innovatsionnaya deyatel'nost' v agrarnom sektore ekonomiki Rossii [Innovational activity in the agrarian sector of Russian economy]. Moscow, Koloss.
10. Tatarkin A. I. (Ed.) (2010). Innovatsionnoe razvitie regionov Rossii. Teoriya, praktika, upravlenie [Innovational development of Russian regions. Theory, practice and management]. Institute of Economics, Ural Branch of the Russian Academy of Sciences. Moscow, Ekonomika [Economics].