



Innovation and Investment Activities in Ensuring the Sustainability of the Functioning and Development of Agricultural Organizations

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Abstract: The study of the process of investment of innovative activities aimed at the internal development of organizations of the agro-industrial complex (agro-industrial complex) in order to obtain a sustainable profit in the medium and long term or other useful effect is relevant in modern economic conditions. The purpose of the work is to determine the value of innovation and investment activities in ensuring the sustainability of the functioning and development of agricultural organizations. The main results of the study were obtained and justified using General scientific methods: ascent from abstract to concrete, comparative analysis, the method of terminological analysis. The qualitative theory of differential equations is used as special tools. Research of stability of innovation and investment systems is based on the classical provisions of the General theory of stability of movement. The essence of functioning and development of innovative and investment activity of the organizations of agrarian and industrial complex as open system is analyzed. It is confirmed that the functioning internally generates development, determined the content of sustainable development for innovation and investment system of agricultural organizations, which reflects the economic, social and environmental results of development. Scientific and methodological provisions concerning the issues of functioning and development of agroindustrial complex organizations, taking into account their specificity, are expanded, which leads to an integrated approach to ensuring.

Keywords: Innovation and investment activities, organizations of the agro-industrial complex, sustainable development, sustainable operation.

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I. INTRODUCTION

Development of any branch of economy is impossible without innovative technologies, advanced technical means, the latest material base on which platform it is possible to construct profitable production. Therefore, among the promising areas of development of the agro-industrial complex (hereinafter – agribusiness) of Russia - innovative technologies. Investments in this direction are considered to be long-term and most effective, because they pursue the goal of introducing new technological solutions in the activities of business structures of agriculture.

In the development of program documents for the development of agriculture, tasks are set, the solution of which, inter alia, involves ensuring the sustainability of agro-industrial production and increasing the investment and innovation attractiveness of the industry.

II. RESULT AND DISCUSSION

Sustainable successful functioning of economic entities is impossible without taking into account the changing environment. Increasing competition, both in the domestic and international market, dictates special conditions for the survival of agricultural organizations, necessitates the development, monitoring and implementation of new advanced processes and technologies - innovation [1]. Today, innovation is perceived as a component of the strategic development of the organization of agriculture investment relationship. As a result, the concept of "innovation and investment activity", which combines innovative and investment processes in a single cycle and complex, is widely spread.

Innovation and investment process associated with the creation and development of new products, equipment, technology through investment is significantly different from the conditions of the established main production. Here, as a result of production, new information about the conditions of production, technological and other parameters and other characteristics of the mastered business processes is considered. Management of innovation and investment activities is to plan to attract real domestic and foreign investments that contribute to the consistent implementation of the innovation process.



Innovation and investment activity can actually spread beyond the boundaries of a single organization of agriculture, which is observed when attracting external sources of investment or having a recognized market success of innovation. An important condition for the effective functioning and development of any economic system is the presence of economic equilibrium, acting as a basis for sustainability. The definition of "stability" is used to describe the constancy of any feature of the studied system, i.e. its immutability, with possible changes in the effects on the system. Stability in a broad sense is interpreted as "the property of the system to return to the original or close to it established mode from various initial States"[2]. In the theory of Lyapunov stability the solution stability for movement, and for the sake of brevity have in mind the sustainability of the systems.

At the same time, innovation and investment activity is an open system in which the emergence of a new element does not contradict, but significantly complements its capabilities.

In mathematics and computer modeling, Lyapunov stability is not the only type of stability. The basic concept is the so-called structural stability, which characterizes the qualitative similarity of different systems when changing different parameters.

The mode of innovation and investment activity of agribusiness organizations as a system can be described by a system of differential equations, in which the generalized coordinates characterizing its state are the parameters of internal and external influences, and their continuous change in time leads to the emergence of transients.

As noted above, the stability of the system is the property of the system to return to its original state after the termination of the external disturbance. The main requirement of sustainability, which is imposed on the system, is to determine the ability of the organization of agriculture to effectively use the factors of production in the medium and long term.

If a sufficiently small disturbance leads to a significant deviation of the regime from the initial (steady) state or from the unperturbed motion, then we should talk about instability or instability of the equilibrium position or unperturbed motion. If, after the termination of the perturbation, the system does not deviate significantly from its initial state, then such a regime is called stable.

Since the motion of the system is described by a system of differential equations, the study of the problem of stability of its motion is reduced to the study of the stability of solutions of differential equations.

We consider the stability of a normal linear homogeneous system of differential equations with constant coefficients

$$\dot{x} = Ax \quad (1)$$

where – square matrix of coefficients; and – vector-functions of dependent variables (investment costs, time horizon, indicators of information technology environment, requirements of stakeholders, etc.) and their derivatives, respectively, recorded in the form of

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}; x = x(t) = \begin{bmatrix} x_1(t) \\ x_2(t) \\ \vdots \\ x_n(t) \end{bmatrix}$$

The General solution of this system is a linear combination of vector functions

$$x(t) = C_1 x_1(t) + C_2 x_2(t) + \dots + C_n x_n(t) \quad (2)$$

where $C_i, i=1,2,\dots,n$ - constant (real or complex) coefficients determined from initial conditions;

$x_i(t)$ - vector-functions of solutions:

$$x_i(t) = e^{p_i t} \begin{bmatrix} k_{1i} \\ k_{2i} \\ \vdots \\ k_{ni} \end{bmatrix}, i=1,2,\dots,n$$

The numbers are the roots of the characteristic equation of the system (1).

To obtain the characteristic equation, the differentiation symbol d/dt is replaced in (1) by the operator, that is, we denote

$$\dot{x}_i = \frac{dx_i}{dt} = p x_i \quad (3)$$

Then the diagonal matrix is formed from the repeated in each equation operator and the resulting system is written in a compact matrix form

$$Px = Ax, \quad (4)$$

$$\text{where } P = \begin{bmatrix} p & 0 & \dots & 0 \\ 0 & p & \dots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & p \end{bmatrix} \quad (5)$$

According to the rules of action with matrices, you can convert the matrix equation (4) to the form

$$(A - P)x = 0, \quad (6)$$

where

$$(A - P) = \begin{bmatrix} a_{11} - p & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} - p & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} - p \end{bmatrix} \quad (7)$$

The determinant of the matrix is called the characteristic determinant. Equating the characteristic determinant to zero, the characteristic equation in the form of the determinant is obtained



$$D(p) = \det(A - P) = \begin{vmatrix} a_{11} - p & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} - p & \dots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \dots & a_{nn} - p \end{vmatrix} \quad (8)$$

Revealing the characteristic determinant in a General form, and grouping the summands by degrees of the operator, the characteristic equation in polynomial form is obtained

$$D(p) = a_0 p^n + a_1 p^{(n-1)} + \dots + a_{n-1} p + a_n = 0 \quad (9)$$

Since the innovation and investment system is directly related to the actual decisions, it is necessary to consider what kind of fundamental system of decisions in each case.

Similarly, the characteristic equation is formed in the case of a linear homogeneous differential equation of the n-th order with constant coefficients

$$a_0 y^{(n)} + a_1 y^{(n-1)} + \dots + a_{n-1} y' + a_n y = 0 \quad (10)$$

The stability of the innovation and investment system is influenced by external and internal factors, but more important are internal mechanisms to ensure the sustainability of the functioning and development of the innovation and investment system. At the same time, the functioning of this system largely simulates stability. Consequently, the stable functioning of the innovation and investment system is provided if it: adequately responds to external and internal influences for timely decision-making; supports the results of activities at a specified time interval; accompanied by continuous prediction of stability of functioning in the intended range of activities. As a result, such quantitative changes in the interaction of subsystems of the system accumulate, which cause the need to change the type of functioning, that is, internally contribute to the development. The interpretation of the term "development" proposed by D. H. Meadows means the expansion and realization of potential opportunities to improve the state, namely: when something develops, it becomes qualitatively better [3].

Any innovative activity at the distributed sources of investment resources which are necessary for implementation of the innovative project and introduction of its results, promotes development of this system which, in turn, leads to scientific and technical development of the organization of agrarian and industrial complex. Innovation and investment development of the system is associated with contradictions ("struggle" of opposites) [4] and trends due to its functioning. At the same time, the functioning serves as the primary basis for the development of the system, since directly at the stage of functioning the prerequisites and opportunities for the transition of the system to a new stage of its improvement and development are formed. There is also a feedback – the impact of the development of the system on its functioning, which consists in the fact that development changes the conditions of functioning and thus strengthens innovative achievements, leads to their implementation, and then – to their elimination, overcoming, destruction. Then the regularity of movement allows us to reach a higher level of productive forces, a set of new scientific knowledge in accordance with the changing needs of the system.

The category of "sustainable development" is multidimensional, integrating economic, environmental and social components. In General, many authors consider "sustainable development" as a process of creating conditions to meet the present and future needs of mankind. At the same time, the concept of "sustainable development" is understood from two perspectives. With a broad approach, sustainable development is seen as a process denoting a new type of functioning of civilization, and in the narrow sense – put to the fore mainly its environmental component.

In the context of our research, sustainable development is a new form of functioning of the production and economic system of the organization focused on the most advanced technologies providing strategic competitiveness in the long term.

The development of the innovation and investment system of the microeconomic level of agriculture should correspond to the trends of changes in the macroeconomic system, in particular, the priorities of economic development, the role of food security in them, the orientation of economic policy to the implementation of the innovation strategy, the creation of a favorable investment climate, where a special role in innovation and investment processes belongs to economic entities acting as the core of economic development and affecting the dynamics of economic growth.

Sustainable development of business structures is achieved through the transition to a qualitatively new level of innovation and investment development, based on the creation of a favorable investment climate. Consequently, the sustainable development of the organization of agriculture is a qualitative characteristic of the process of technological and economic development. Sustainable development can be expressed as a process (fig. 1), which reflects the results of the laws of simultaneous development of all three components, characteristic of the innovation and investment system of agricultural organizations.

Social result, the goal – the development of the social sphere, meeting the needs of employees

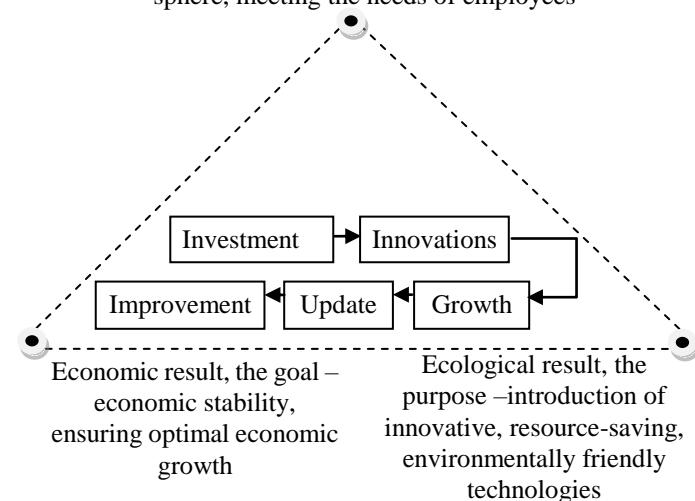


Fig. 1. The content of sustainable development for the innovation and investment system of agricultural organizations

Innovation and investment activities in ensuring the sustainability of the functioning and development of agricultural organizations

Sustainable development of agribusiness organizations is associated with a chain of successive interrelated innovations, as investment is concentrated in innovation, expanded reproduction of production factors. Investment support of various innovative assets in various forms generates a constant production of innovative products of agriculture. The greater the increase in the production of innovative agricultural products on investment in innovative assets, the higher the efficiency of investment support for innovative development of agricultural organizations.

Development and implementation of innovations is the basis of economic growth. Investment is the process of financing economic growth, and innovation is the direction of investment. In the context of sustainable development of agribusiness organizations provides for the growth of not only production and income, but also requires the use of high-quality human labor potential, which is formed as a result of social efficiency.

As a result of changes there is an updating or improvement of activity of the organization of agrarian and industrial complex which lead to replacement of one objects (elements) by others, or addition of earlier existing new.

It should be noted that an important feature of agribusiness organizations is that in innovation processes the vast majority of innovations are improving, since most innovations, such as new varieties of plants, new fertilizers and plant and animal protection products, other technical and technological innovations, are not associated with the need for complex and time-consuming design and technological works in relation to agribusiness organizations. If there are basic innovations, they more deeply affect the producers of agricultural machinery, biological products and other representatives of agro-industrial production. Consequently, the improvement of the functional qualities of the object or process leads to natural organic development. The improvement does not affect the normal existence of the system, characterized by a relatively small impact on the dynamics of the application object.

III. CONCLUSION

Innovation and investment activity is not only a factor of development, but also a factor of transformation of the conditions of functioning of agricultural organizations. Investment flows innovation and innovations themselves directly included in the outline of the operation, thereby ensuring the development itself.

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REFERENCES

1. A. Orlov, Management: Textbook. Moscow: Publishing House "Izumrud", 2003.
2. V. Glushkov, *Encyclopedia of Cybernetics*, vol. 2. Kyiv: Ukrainian Soviet encyclopedia, 1975.
3. D. Meadows, J. Randers, D. Meadows, *The limits to growth: the 30-year update*. London-Sterling, VA: Earthscan, 2004.
4. V. Lenin, *Philosophical notebooks*. Moscow: State publishing house of political literature, 1947.

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