

# Methods for Evaluating and Improving the Effectiveness of Management of Integrated Structures in the Agro-Industrial Complex

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**Abstract**—The purpose of the research is to develop proposals for improving the management of a modern vertically integrated agro-industrial formation created in the Belgorod region of Russia on the basis of the APC "Collective farm named after Gorin". During the analysis of production and commercial activities, it was found that in 2017-2019 there was a simple growth rate of resource efficiency indicators, which is calculated as the average index of individual indices using the geometric mean formula. The discounted growth rate of resource efficiency indicators for this period was 118.4%. The authors propose formula that allows to calculate the price level for agricultural raw materials, which provides equal payback for standard variable costs in the production of agricultural raw materials and its processing. If the actual variable costs are less than the standard costs, the company will receive margin income that exceeds the standard value. In order for the anti-cost mechanism to work, two main conditions must be met. First, regulatory variable costs must be justified and correspond to the capabilities of related enterprises. Secondly, the revision of the cost standards should be carried out only on sufficient grounds, for example, when switching to a fundamentally new technological level.

**Keywords**—*agro-industrial formations, management efficiency, approaches to efficiency assessment, corporate effect, cost-effective mechanism, pricing for agricultural raw materials*

## I. INTRODUCTION

Improving the economic efficiency of managing integrated structures in the agro-industrial complex is an important research area, since the latest achievements in the agricultural economy are mainly related to the development of large-scale multifunctional agro-industrial production. The history of economic activity of the majority of agro-industrial formations does not exceed two decades, which means that the possibilities for improving their management have not yet been exhausted.

So far, the most intensive processes of agro-industrial integration have taken place "from above" at the initiative and under the management of the owners of processing enterprises [15, 16]. Recently, agro-industrial integration "from below" has been spreading at the initiative and under the management of the owners of agricultural organizations [12]. Reserves for improving management efficiency are most in demand for integrated structures that are at the beginning of their life cycle.

Despite the continuing importance of the problem of measuring and increasing the effectiveness of enterprise management, regardless of their specialization, structure and size, there is still no convincing theory and methodology that allows us to uniquely interpret and measure the effectiveness of enterprise management.

Thus, in the methodological recommendations of Rosinformagrotech in paragraph 1.5.2. "Effectiveness of the organizational and managerial subsystem of an agricultural organization" on page 38, it is noted that "the definition of management effectiveness is reduced to assessing the role of managers in achieving the goal and improving production efficiency. To do this, it is necessary to use indicators that reflect the growth of production efficiency as a result of management efficiency", and the following definition is given: "Economic management efficiency is the level of creating economic conditions for the implementation of expanded reproduction of an agricultural organization" [3]. Previously on page 36 in this paper, a general criterion of management efficiency is formulated "as a result of the functioning of a management system that ensures the achievement of the goals set for the object of management at the lowest cost" [3]. In this article, two concepts are mixed: "enterprise goal" and "production efficiency", which often overlap, but may have an independent meaning in the practice of managing an agro-industrial enterprise.

This confusion of ideas is quite common. For example, the opinion of O.N. Shevtsova, V.M. Galinou and S.V. Volkova that should distinguish between the economic efficiency of enterprises and enterprise management efficiency, combined with the statement that to evaluate the last important increase of efficiency of activity of the enterprise, caused by control actions [10].

While the vast majority of researchers consider economic efficiency as the ratio of effect to cost or as the ratio of the resulting economic effect to its target value, the effectiveness of enterprise management is interpreted in different ways. The latter circumstance causes attempts to classify the opinions of researchers about the content of the concept of "enterprise management efficiency". One of these attempts was made by O.V. Kharitonova, who gives a wide list of approaches described in the literature to assess the effectiveness of enterprise management [6].

In our opinion, the most common five approaches to assessing the effectiveness of enterprise management (table 1).

TABLE I. EXISTING APPROACHES TO ASSESSING THE EFFECTIVENESS OF ENTERPRISE MANAGEMENT

Approach	The essence of the approach
Resource approach	The effectiveness of enterprise management is evaluated by the level of activity efficiency, which in turn is measured by the ratio of the company's performance results to available resources
Stereotypical	The efficiency of enterprise management is estimated as the ratio of the results of the enterprise to the cost of management
Private	The effectiveness of enterprise management is assessed by the level of efficiency of management work, by the level of efficiency of individual management decisions
Combined	The effectiveness of enterprise management is evaluated by a set of indicators that characterize the effectiveness of the enterprise and the effectiveness of specific management actions
Targeted	The effectiveness of enterprise management is assessed by the degree of achievement of the company's goals

An example of a resource approach is the statement of K.A. Zadumkin: the more inefficient the management system is, the more resources (temporary, financial, material) are needed to achieve the set results [14]. Many agree with the resource approach, since resource constraints are a determining factor in the development of economic systems, and the current and future well-being of individuals and society as a whole depends on how these resources are used. However, the resource approach is also limited. The company's management can maintain a high "results / costs" ratio without developing the resource base. In the history of mankind, one of the largest "results / costs" ratios has occurred in gathering.

By analogy with the resource approach, the economic efficiency of management is considered by some authors as the ratio of the result obtained to management costs. This stereotypical approach is justified if it is possible to measure the effect of specific management actions, and then correlate it with the costs generated by these actions. An attempt to evaluate the effectiveness of management, for example, by dividing the annual profit by management costs, does not meet the interests of most stakeholders. The owners of the

enterprise are not interested in this ratio, but in the dividends that they will receive. V.I. Malyuk critically assesses the stereotypical approach and rightly notes that it is hardly possible to allocate the part of the overall result that was provided by the rational management of the organization. It is also difficult to estimate the overall management costs [8].

The private approach involves measuring the effectiveness of enterprise management by the level of efficiency of management work, by the level of efficiency of individual management decisions. An example of this approach is the methodology for evaluating and improving the effectiveness of management processes in an enterprise, described in the work of D.A. Shageev and E.S. Kolotukhina [9].

The combined approach is the most popular, which is due to the desire of researchers to link the assessment of the effectiveness of the enterprise with the assessment of the effectiveness of management activities. This is partly due to the fact that they are aware of the limitations of the resource and private approaches. For example, O.V. Kharitonova suggests to evaluate the management efficiency of agro-industrial enterprises to use a generalized indicator of management efficiency, taking into account the level of management efficiency and the level of production efficiency [6]. Shevchenko considers the effectiveness of the industrial enterprise management system as a function (result) of the effectiveness of the management object and the effectiveness of the subject of management [2].

The most adequate to task of evaluating the effectiveness of management is the targeted approach. N.N. Yarkina notes that in a broad sense, the essence of management activity is reduced to setting goals, developing algorithms and organizing their achievement, which determines the need to use a target approach to evaluating the effectiveness of enterprise management. At the same time, the target approach does not contradict, but rather complements the resource approach, expanding the range of traditional performance indicators that correlate results and costs, at the expense of targets built on a different methodological basis that characterize the quality of management decisions in the field of competitiveness, innovation and investment, marketing, business risks, etc., reflecting the success of the enterprise's interaction with environmental factors [13].

V.I. Malyuk identifies two aspects of the target approach to assessing management effectiveness: 1) the accuracy of target setting; 2) the degree of implementation of the goals and tasks accepted for execution in the established time frame [8]. Therefore, the target approach is justified if the goal setting function is performed properly: the set goals meet the interests of the company's stakeholders and are designed for an acceptable level of effort of managers and performers.

It seems that the solution to the problem of interpreting and measuring the effectiveness of enterprise management is possible, not so much by contrasting the approaches considered, but by supplementing them with an interest-oriented approach. The effectiveness of enterprise management can only be measured and interpreted unambiguously based on a specific interest. It is obvious that when evaluating management in general and specific management decisions, it is difficult to be guided by such a large set of indicators, especially since they partially duplicate each other, and partially change in opposite directions. Therefore, it is more practical to use several indicators that

directly reflect the interests of the owners of the enterprise and other persons on whose activities the production and commercial results of the enterprise depend.

At the same time, we should not ignore the general patterns that affect the assessment of management activities and the content of the developed measures to improve management efficiency. In particular, the concept of the types and causes of management inefficiency deserves attention and development. A.N. Tsvetkov describes two types of inefficiency in enterprise management: 1) technical inefficiency of management, which is expressed in the uneconomical use of all types of resources due to technological or managerial imperfections; 2) economic inefficiency of management, manifested in the rejection of the best alternative use of the organization's resources [11]. For an integrator company that performs the function of a holding company in addition to its production functions, a third type of inefficiency should also be taken into account: corporate inefficiency, which is expressed in incomplete receipt of the corporate effect. In general, the corporate effect is achieved by combining the interests of partners in agro-industrial formation and joint actions to create added value.

M.N. Kabanenko, S.N. Ugrimova and N.A. Andreeva note that the creation of a modern holding company in the agro-industrial complex provides for the establishment of direct links between participants, the elimination of intermediaries, reducing indirect costs and increasing profits, ensuring the financial stability of its participants [5].

The main economic effect of agro-industrial integration is achieved by introducing into the economic space of agricultural production those links in the value chain that previously belonged to industrial monopolistic structures. As noted on this occasion I.V. Emanuel, from the point of view of agricultural enterprises, the goal of forming a vertical integrated structure is to establish such organizational and economic relationships between farms and the processing enterprise that would ensure maximum satisfaction of the needs of agricultural producers in the timely processing and sale of agricultural products, subsequent reimbursement of costs and obtaining a share of profits distributed among the integration participants in accordance with their contribution to the overall result [4].

S.A. Kozhevnikov calls the main prerequisite for the formation of vertically integrated companies the presence of intersectoral relations between producers and processors of products. The tasks to be solved include: creating an economic structure that is resistant to the influence of external and internal factors; ensuring the consolidation of financial flows; reducing the need for working capital; increasing total assets; and centralizing business processes [7].

Therefore, the assessment of the effectiveness of management of integrated structures and the development of management improvement proposals based on it should take into account all possible types of inefficiency and rely on all types of approaches considered. The main economic indicator that should be used to judge the effectiveness of management of an enterprise, its individual branches and agro-industrial formation as a whole is value added, since changes in the value added affect the interests of the owners of the enterprise (in terms of profits), employees (in terms of wages) and the budget system (in terms of tax deductions).

**II. METHODOLOGY**

Evaluation of management efficiency and development of proposals for improving the management of agro-industrial formation was carried out on the materials of the agro-industrial formation created on the basis of the agricultural production cooperative "Collective farm named after Gorin". The purpose of the research is to develop proposals for improving the management of a modern vertically integrated agro-industrial formation. An assessment of the efficiency of using production resources is given. Designed simple and discounted indices of resource efficiency APC "Collective farm named after Gorin". Using a correlation and regression analysis performed on a set of enterprises in the Belgorod region, it was established that there are reserves for increasing the efficiency of the main branch of the APC "Collective farm named after Gorin" – pig farming. To improve the efficiency of managing the interaction of related enterprises that are part of the agro-industrial formation, an anticost pricing mechanism is justified.

**III. RESULTS AND DISCUSSION**

The analysis of production and commercial activities of an integrated agro-industrial formation shows that it is a chain of technologically and economically connected centers of value creation. The movement of the value added stream is illustrated in figure 1.

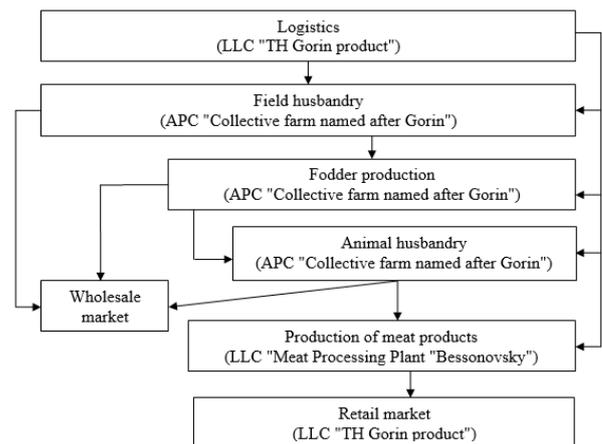


Fig. 1. Value added flow in the integrated agro-industrial formation created on the basis of the APC "Collective farm named after Gorin"

The flow of added value begins to form in the field-growing divisions of the APC "Collective farm named after Gorin", which grow crops and produce grain, sunflower seeds, green mass of annual and perennial grasses, corn, vegetables and potatoes. The bulk of this product is used in feed production for obtaining compound feed, silage, haylage, hay and green feed.

Feed production is the second center of added value after field production. The produced feed is used in animal husbandry for the production of milk and growing live weight of pigs and cattle. Animal husbandry is the third center of financial responsibility. Live weight of pigs and cattle is sold in LLC "Meat Processing Plant "Bessonovsky", which acts as the fourth center of financial responsibility of the agricultural holding. The fifth and final center of financial responsibility is the retail chain of LLC "TH Gorin product", which sells meat products received from the meat processing plant to the final consumer. Thus, the economic and technological

interrelation of the listed centers of financial responsibility is obvious. Mismanagement in any financial responsibility center results in loss of added value created in previous centers and missed opportunities for subsequent centers.

The predominant share of added value of agro-industrial formation is formed in the APC "Collective farm named after Gorin" and LLC "Meat Processing Plant "Bessonovsky". At the end of 2019, the value added of these two enterprises amounted to 995 million rubles (table 2).

TABLE II. ECONOMIC EFFICIENCY OF PRODUCTION RESOURCE MANAGEMENT OF APC "COLLECTIVE FARM NAMED AFTER GORIN" AND LLC "MEAT PROCESSING PLANT "BESSONOVSKY"

Indicators	2017	2018	2019	2019 in % to 2017
Value added, million rubles	729	827	995	136.5
Average annual number of employees, people	1650	1614	1596	96.7
Arable land, ha	16468	16501	16400	99.6
Residual value of fixed assets at the end of the year, RUB mln	3028	3222	3289	108.6
Added value in the calculation:				
per 1 employee, thousand rubles	442	513	624	141.1
per 1 ha of arable land, thousand rubles	44.3	50.1	60.7	137.0
per thousand rubles of fixed assets, RUB	241	257	303	125.6
A simple index of resource efficiency				134.4
Discounted resource efficiency index				118.4
A simple index of resource efficiency				134.4

The main production resources of the agro-industrial formation are personnel, arable land and fixed production assets. In 2017-2019, the efficiency of using each of these resources has increased. Therefore, the simple resource efficiency index calculated using the geometric mean formula from individual indexes exceeds 100%:

$$\sqrt[3]{141.1 \times 137.0 \times 125.6} = 134.4\%.$$

To bring the cost indicators of different years to a comparable form, it is necessary to adjust the growth rate of resource efficiency indicators using the discount procedure. Thus, at a discount rate of 10%, the discounted resource efficiency index is

$$\sqrt[3]{\frac{141.1}{1.1^2} \times \frac{137.0}{1.1^2} \times 125.6} = 118.4\%.$$

Consequently, in general, for the totality of the used production resources, an increase in the efficiency of their use is observed, even taking into account the discounted value added.

The analysis is based on resource-based and interest-based approaches. It is also desirable to obtain an assessment of the effectiveness of management based on a targeted approach.

The targeted approach to evaluating the effectiveness of management is implemented by correlating the result obtained with the possible result with the best use of resources. If it is difficult to evaluate the result with the best use of resources, use the result obtained in other enterprises as a comparison base. In any case, a comparison with other companies will not be superfluous. Here it is important to implement the principle of the only difference and compare the effectiveness of management of specific and economically significant activities. Such activity for the APC "Collective farm named after Gorin" is pig farming.

Over the past three years, pig farming has accounted for more than 58% of the total farm revenue. At the same time, according to the average daily increase in live weight of pigs, the APC "Collective farm named after Gorin" was inferior in 2017 to six enterprises of the Belgorod region, and in 2018 – to seven enterprises.

The correlation and regression analysis performed on the aggregate of pig breeding enterprises in the Belgorod region for 2017-2018 showed that there is a statistical relationship between the average daily weight gain of pigs and the cost of live weight, which is described by the equation

$$Y = 129.7 - 0.1125X, \tag{1}$$

where Y – the expected cost of 1 ton of live weight of pigs, thousand rubles; X – average daily increase in body weight, g.

The correlation coefficient is -0.579. The graph of dependence and the correlation field are shown in Figure 2. It follows from the obtained equation that with an increase in the average daily gain in live weight of pigs by 1 g, the cost of 1 ton of live weight of pigs decreases by 112 rubles.

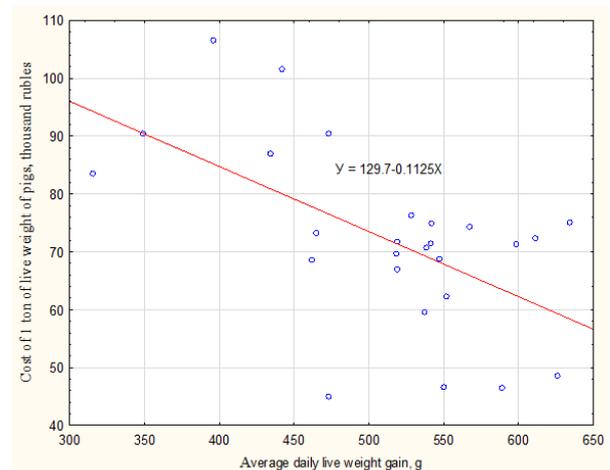


Fig. 2. The relationship between the average daily weight gain of pigs and the cost of live weight

Substituting into equation (1) the data of the APC "Collective farm named after Gorin" on the average daily weight gain shows that there are deviations of the actual cost level from the expected values for this equation (table 3).

TABLE III. ANALYSIS OF DEVIATIONS IN THE COST OF LIVE WEIGHT OF PIGS FROM THE EXPECTED LEVEL IN THE APC "COLLECTIVE FARM NAMED AFTER GORIN"

Indicators	2017	2018
Actual average daily weight gain of live weight of pigs, g	519	541
Actual cost of live weight of pigs, thousand rubles per ton	71.772	71.535
The expected cost, calculated according to the equation (1), thousand rubles per ton	71.313	68.838
The actual level of cost to expect, thousand rubles per ton	+0.459	+2.697

According to table 3, in 2017, the efficiency of the pig industry of the APC "Collective farm named after Gorin" in the ratio "growth-cost" was slightly lower than the average for the region, since the actual cost of live weight was higher than expected by 0.459 thousand rubles per ton. In 2018, the efficiency of raising pigs in the ratio "growth-cost" significantly decreased. The analysis shows that the APC "Collective farm named after Gorin" has significant reserves for increasing added value by increasing the productivity of pigs and subsequently reducing the cost of production.

Reducing the cost of live weight of pigs is relevant not only for the agricultural enterprise, but also for the agro-industrial sector as a whole, since it expands the space for regulating the level of transfer price for live weight of pigs, which allows maintaining mutually beneficial relations between related enterprises. The APC "Collective farm named after Gorin" applies the practice of creating new subsidiaries, in which at the first stage the property complex of a new business direction is formed; at the second stage, the staff is selected; at the third stage, the created division is allocated to a legal entity by creating a subsidiary limited liability company.

After the implementation of the third stage, there is an objective need to organize effective intra-holding relations between related enterprises. The organization of intra-holding relations between related enterprises is based on the self-sufficiency of the parties, on the one hand, and on the other hand on the centralized management of the process of concluding and executing purchase and sale transactions. The price must be an element of a cost-effective mechanism. Its level and the procedure for determining it should encourage related enterprises to take constructive actions to improve the economic efficiency of their own activities by reducing the cost and improving the quality of products. A rational solution is to determine the price based on the principle of equal payback of normative variable costs [1]. We suggest calculating the price of agricultural raw materials using the following formula:

$$d = \frac{ac}{a+b}, \quad (2)$$

where  $d$  - basic price of agricultural raw materials, RUB/kg;  $a$  - standard unit variable costs for the production of agricultural raw materials, RUB/kg;  $b$  - standard unit variable costs for the processing of agricultural raw materials without the cost of purchasing them, RUB/kg;  $c$  - proceeds from the sale of products made from 1 kg of agricultural raw materials, RUB (complex production price).

For example, with specific variable costs for the production of live weight of pigs 54 RUB/kg, variable costs for processing (excluding costs for the purchase of pigs) 92 RUB/kg and a complex production price of 232 RUB/kg, the purchase price for live weight of pigs will be

$$d = \frac{54 \times 232}{54 + 92} = 85.8 \text{ RUB/kg}$$

Formula (2) makes it possible to calculate the price level for agricultural raw materials, which ensures equal payback of standard variable costs in the production of agricultural raw materials and in their processing. In the example considered, the return on standard variable costs is 159%:

$$\frac{d}{a} = \frac{85.2}{54} = 159\% \text{ and}$$

$$\frac{c-d}{b} = \frac{232-85.8}{92} = 159\%.$$

If the actual variable costs are less than the standard, then the company will receive a marginal income that exceeds the standard value. In order for the counter-cost mechanism, incorporated by pricing according to formula (2), to work, it is necessary to provide two basic conditions. First, the target variable costs must be justified and appropriate to the capabilities of related businesses. Secondly, the revision of the cost norms should be carried out only if there are sufficient grounds for that, for example, when moving to a fundamentally new technological level.

#### IV. CONCLUSIONS

Assessment of the effectiveness of management of integrated structures in the agro-industrial complex can be carried out using various approaches. The most relevant is the complex application of resource, targeted and interest-oriented approaches. The performed analysis of the activities of modern agro-industrial formation showed that there are reserves for improving management efficiency both in the sphere of production and in the sphere of interaction of related enterprises. To increase the return on production resources and increase value added in the interests of the main stakeholders, it is necessary to form an anti-cost mechanism that orients enterprises that are part of the agro-industrial formation to fulfill mutual obligations with the lowest costs. A key element of the cost-saving mechanism should be the establishment of transfer prices that ensure equal payback for variable costs of related enterprises. The cost-effective pricing mechanism will allow you to effectively manage the interaction of related enterprises in the agro-industrial formation.

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