



## Multi-Optional Forecasting of Agricultural Enterprises Activity and Development Indicators

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**Abstract:** *In the article, short-term multivariate forecasts of the gross product of farms specializing in agriculture are developed on the example of the "Agro-Boysun" farm. Scientifically based proposals and conclusions on further improvement of the prospects of the "Agro-Boysun" farm using these forecast options are presented.*

**Keywords:** *agriculture, agricultural enterprises, level of agricultural potential, modeling, forecasting.*

### Introduction

It is one of the leading branches of the agricultural economy in the Republic of Uzbekistan. 49.4 percent of the republic's population lives in rural areas, and the share of agriculture in the gross domestic product is 19.7 percent. Also, in 2022, the number of enterprises specializing in agriculture exceeded 157 thousand, corresponding to 40.6% of the total operating enterprises, and 27.3% of the economically active population worked in this sector, and the sector's share in the republic's gross product was almost 35% [2].

That is why the President of the republic Shavkat Mirziyoev said that "reforming the management system of the agricultural sector, introducing advanced technologies for the rational use of land and water resources, ensuring food safety is our most important task... We must never forget this..." pointed out that this issue is important [1].

Taking into account the above, it can be said that it is appropriate to develop demands and proposals for future prospects by analyzing the development of this industry at a micro level and determining the forecast results. But due to the uncertainty characteristics of this field, the use of existing forecasting methods does not always give effective results.

### Analysis of literature on the topic

Many scientific researches have been carried out on modeling the activity of agricultural enterprises and forecasting development indicators in economic sectors. The scientific and practical issues of economic analysis of the activity of agricultural enterprises have been extensively researched in the scientific works of economists, among which the works of L.P. Vladimirova, V.V.Kuznetsov and other scientists can be cited.

L.P. Vladimirova, one of the foreign scientists, researched the forecasting of the activities of agricultural enterprises, and it was shown that the agricultural development programs in the region justify the processes of forecasting in this area in more detail [3].

V.V. Kuznetsov also studied the issues of modeling the activity of agricultural enterprises and forecasting their prospects, and in his opinion, the starting point of these forecasting forms, similar to the content of forecasting the main indicators of the activity of agricultural enterprises in the region, is indicated by the analysis of agricultural development trends [4].

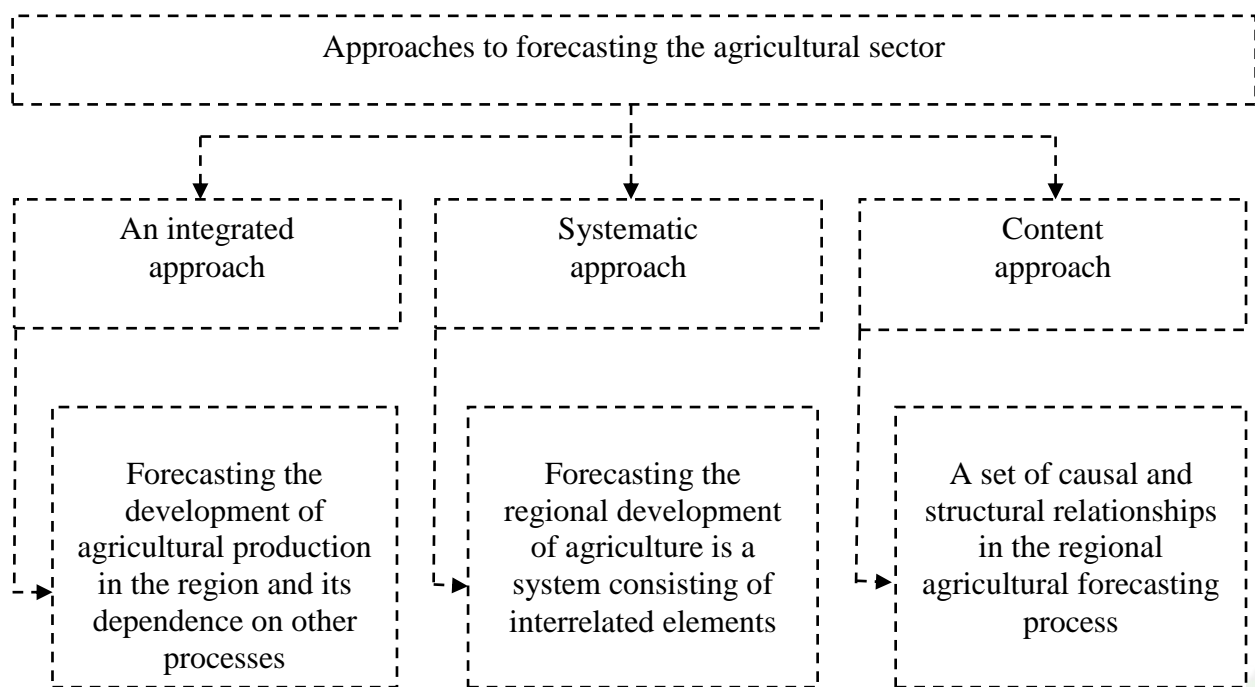
**Research methodology**

The main purpose of the research is to develop scientific and practical proposals and recommendations for the development of the future prospects of a specialized agricultural enterprise (farm) by implementing modeling processes based on trend models, multivariate forecasting, correlation and regression analysis. Comparison, correlation and regression analysis, grouping and economic-statistical methods were widely used in the research process. As a result of the research, the model of the processes of the gross product of the "Agro-Boysun" farm and multi-variant forecasts for the medium term were determined, and scientific and practical proposals were developed to further increase this indicator. The developed scientific and practical proposals and recommendations can be used in the development of targeted state programs for the organization of food safety policy in our country and its improvement.

**Analysis and results**

Forecasting of economic processes is explained by scientific forecasting of the direction of economic development in the future, its individual elements, or determination of optimal methods of achieving goals. The correct choice of the forecasting method in the processes of this type ensures the quality of the forecast.

Usually, in the economic literature, special attention is paid to the analysis of the structural base in order to forecast the development of the regional agriculture. Various definitions devoted to the characteristics of forecasting in agriculture and to reveal the essence of this process are systematized within three approaches[4]. These are integrated, systematic and structural approaches (Figure 1).



**Figure 1. Approaches to forecasting the agricultural sector**

In these approaches, attention is paid to the meaningful description of the forecasting of agricultural development in the region, the accuracy of forecasting and assessment of production factors, and the geographical features of management.



Since all of the above approaches to forecasting the agricultural sector are related to the activities of agricultural enterprises, it is appropriate to forecast the future prospects of this sector at the micro (agricultural enterprises) level.

If we pay attention to the analysis of this situation on the example of the farm "Agro-Boysun" specializing in the field of agriculture, the following picture can be seen.

"Agro-Boysun" farm operates in Boysun district of Surkhandarya region. The main activities of the farm:

- production and sale of grain products;
- production and sale of field crop products;
- production and sale of grape products;
- production and sale of milk and meat products;
- implementation of agricultural measures to increase the productivity of one's soil;

In 2022, the gross output of Agro-Boysun farm amounted to 64,871.8 million soums, including the cultivation of agricultural products 27,036.3 million soums (41.7%), and livestock products 37,859.7 million soums (58.3%)

**Table 1 Gross agricultural product of "Agro-Boysun" farm (at real prices, million soums)**

Year	Everything	Agriculture	
		Farming	Animal husbandry
2010	8 198,6	3 050,5	5 148,1
2011	13 048,9	5 676,3	7 373,6
2012	16 769,0	7 344,8	9 424,2
2013	19 428,0	10 313,2	9 114,8
2014	21 841,0	11 600,0	10 241,0
2015	25 633,0	12 500,0	13 133,0
2016	29 381,9	15 634,5	13 747,4
2017	34 643,9	17 605,9	17 038,0
2018	40 901,8	19 849,7	21 052,2
2019	45 189,3	22 728,0	22 461,3
2020	49 424,1	24 810,1	24 614,0
2021	56 900,0	26 900,0	30 000,0
2022	64 871,8	27 036,3	37 859,7

In our study, the method of forecasting the gross share of "Agro-Boysun" farm is based on trend models and regression model forecasting. This allows you to get reliable and versatile results.

Based on the trend models, the results of the multi-variant forecast for the medium term show that the priority trend of gross agricultural development in 2010-2022 will be preserved at the "Agro-Boysun" farm. The forecast results are presented in Table 2.

**Table 2 Forecast indicators of the gross share of "Agro-Boysun" farm according to trend models are mln. soum.**

Forecast model	Trend models	R <sup>2</sup>	Absolute mistake	Prognosis			
				2023	2024	2025	2026
Linear	$y = 4474,3 t + 1466,6$	0,978	2125,2	64106,8	68581,1	73055,4	77529,7
Quadratic	$y = 181,77 t^2 + 1929,5 t + 7828,7$	0,996	822,4	70468,6	77669,4	85233,8	93161,7
Exponential	$y = 9491,7 e^{0,1549 t}$	0,968	2198,8	83014,7	96923,1	113161,7	132120,9



The analysis of the adequacy and accuracy characteristics of the trend models presented in Table 2 shows that there is a very strong correlation between the coefficients of determination in all three models, but in the second model, it can be observed that the average absolute error is less than the first and third models. Therefore, the indicator of the gross share of the farm "Agro-Boysun" corresponds to a flat accelerated development.

During the correlation-regression analysis of our analysis, the impact of various factors on the dynamics of the gross product of the "Agro-Boysun" farm was determined. Correlation-regression method allows to take into account the influence of various factors in predictive calculations. During the research, we selected the following factors: the productivity of the main types of crops (cereals, vegetables, fruits, grapes, etc.) grown at the "Agro-Boysun" farm, as well as the main indicators of livestock productivity (calf productivity per 100 cows, average milk production per cow) . The forecast results for the above indicators obtained from the data of the "Agro-Boysun" farm for the years 2010–2022 are presented in Table 3.

**Table 3 Forecast of indicators of agricultural products of "Agro-Boysun" farm in 2010-2022**

Indicator	2010-2022 average	2023	2024	2025	2026
Grain yield, ts	20,7	19,3	19,9	19,6	19,2
Vegetable productivity, ts	260,4	268,8	277,2	285,5	293,9
Wet fruit yield, ts	56,3	59,1	61,8	64,6	67,3
Grape productivity, ts	56,0	52,4	48,8	45,2	41,6
Calf productivity per 100 cows	86	88	90	92	94
Average milk yield per cow, kg	2213,7	2414,1	2614,5	2814,9	3015,3

3-жадвалга кўра, прогноз қилинган даврда (2023–2026) "Агро-Бойсун" фермер хўжалиги фаолиятида дон ва узум маҳсулотлари ҳосилдорлиги пасайиши кузатилмоқда. Ўрганиш даврида узумнинг юқори ҳосилдорлиги 2013 йилда 78,2 ц. ни ташкил этган бўлса, энг паст кўрсаткич 2022 йилда 35,9 ц. ни ташкил этган.

Correlational analysis of dependence on the gross agricultural product of the Republic of Uzbekistan for 2010-2022 showed that the productivity of fruits and vegetables from our selected indicators is correlated with both indicators of livestock productivity. Correlation coefficients between them ranged from 0.90 to 0.98, indicating that grain and grape yields were not related to other factors. As a result, milk yield from 1 cow is chosen among multidirectional factors and the following regression model is created:

$$y = 18201,7 + 61,8x_1 - 214,8x_2 + 25,2x_3;$$

where, y is the gross product of agriculture, million soums;

$x_1$  - grain yield, ts;

$x_2$  – grape yield, ts;

$x_3$  - average milk yield from 1 cow, kg;

Based on the results of the correlation-regression analysis, the coefficient of correlation coefficient R in the gross share of "Agro-Boysun" farm, which is 0.95, indicates that there is a close relationship between the factors.

The coefficient of determination  $R^2$  shows that about 91 percent of the gross share of the farm "Agro-Boysun" is conditioned by the influence of the factors included in the model. The result of testing the significance of regression based on Fisher's F-test showed that the regression equation was significant. The results of evaluating the significance of the regression coefficients using the Student's t test showed that all the coefficients were significant.



The analysis of the obtained regression equations shows that the factor x1 (grain yield) has the greatest influence on the gross share of the "Agro-Boysun" farm in terms of absolute growth: a 1% increase in the grain yield leads to a 10% increase in the gross share of the "Agro-Boysun" farm. will come A 1% increase in the yield of grapes provides a 7% increase in the farm's gross share, a 1% increase in milk yield from 1 cow provides a 3% increase in its gross share.

Now, using the predicted values of the factors in the table, we can calculate the predicted values of the gross share of the farm "Agro-Boysun" using the regression model.

Thus, the forecast of the gross agricultural product of the "Agro-Boysun" farm in 2023–2026 according to the regression model is presented in column 2 of Table 4.

**Table 4 The results of forecasting the gross product of "Agro-Boysun" farm by different methods. million soum**

Year	Forecast by regression model	Forecast by Trent model
2023	68974,2	70468,6
2024	74834,6	77669,4
2025	80639,5	85233,8
2026	86438,1	93161,7

Compared to the forecasts presented in the table, the forecasts based on the regression model look more realistic. In fact, in 2022, the actual value of the gross product was 64,871.8 million soums. The forecast values determined by the Trent model are observed to be unreasonably high or unacceptable for the coming year 2026.

According to the results of the analysis, in forecasting the gross share of the Agro-Boysun farm, it is necessary to forecast the productivity of grain and grapes, as well as indicators of milking per 1 cow, and then forecast the studied effective indicator using a regression model.

## Conclusions and suggestions

In summary, the stages of creating forecast options described in this work is a system of interrelated economic and mathematical models. Therefore, we can say that the implementation of the proposed forecasting algorithm allows the regional agro-industry network to choose the most effective direction of economic development.

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