

Assessment of the impact of agriculture on the regional socio-economic development

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Abstract. This article analyzed the impact of agriculture on the regional economy, population employment and export potential. Studies show that the volume of agricultural production and its export has a significant impact on the region's gross regional product, employment and income. Also, the study shows that the coefficient of elasticity of the volume of agricultural products is high, and the development of agriculture has a significant impact on the growth of the regional economy. In addition, the article emphasized the importance of developing agriculture-related industries and services for sustainable growth. In the article, regression and correlation analyzes were used to determine the relationship between agriculture and other economic indicators.

1 Introduction

We can recognize agriculture as the main sector contributing to economic development [1]. In many regions of the world, agriculture is the backbone of the economy, providing employment and contributing to the comprehensive development of the region [2]. However, the relationship between agriculture and economic development is complex and multifaceted. In order to guide effective policy interventions, the true impact of agriculture on the socio-economic development of the region needs to be determined. In recent years, econometric models have been widely used to assess the impact of agriculture on socio-economic development [1]. These models help researchers and policymakers understand the relationship between agriculture and other sectors of the economy, as well as the drivers of economic growth in the region. By identifying key drivers of agricultural development and their impact on the overall economy, these models can be used to guide policy interventions and promote sustainable development [3]. The use of econometric models in agricultural research has received increasing attention in recent years, many studies show the effectiveness of these models in forecasting and evaluating the impact of agriculture on socio-economic development.

Therefore, this research aims to provide complete information about various econometric models used in assessing the impact of agriculture on socio-economic development, their strengths and weaknesses, and their application in different regional contexts. The paper uses existing literature and empirical data to analyze the performance of various econometric

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models and provides insight into their potential applications in future research and policy development.

2 Literature review

Many scientists have studied the need to improve the methodology of assessing the impact of agriculture on the socio-economic development of the region, monitoring, calculating and analyzing the income of producers, as well as the contribution of industry to the development of regions and the country. Based on the analysis, we can say that agriculture has a significant impact on the socio-economic development of the region, and its importance and impact differ by region [4]. The potential of the agricultural sector in contributing to the integrated development of the regional economy is considered very high [5]. The fact that agriculture is an important factor of economic growth in the entire region and contributes to the increase of the gross regional product is substantiated in the works of many scientists [6]. The impact of agricultural policy is not limited to agriculture, but directly and indirectly affects other sectors as well as the region's total output, employment and household income [7]. Agriculture has significant productivity in terms of GDP [8]. Agriculture should not be neglected in favor of other sectors and should be encouraged to accelerate a smooth economic transition [9]. Agricultural innovations are not only new or improved products, but also models and systems that should have a positive social impact. Developing countries focus more on production and distribution, while developed countries focus more on supply of raw materials [10]. We can see that private sector investment in agricultural innovation is growing faster than public sector investment [11]. Innovations are in the medium term and are usually adopted by only a part of the market. The effects of innovation include institutional, political, scientific, and manufacturing domains [12]. The main purpose of assessing the impact on agriculture is to analyze the economic efficiency of investments in innovations [13]. Today, there are many cases of using complex and multifaceted approaches to evaluate the impact of innovations in agriculture [14]. Today, along with agriculture, other goals such as food security, environmental protection, and poverty reduction are gaining importance [15]. Government agricultural extension programs have a positive impact on farmers' knowledge, technology, farming practices, technology adoption, farm productivity and output [16]. However, the impact may vary depending on factors such as education level and infrastructure. Providing farmers with the right information is essential to improve their decision-making ability and improve agricultural productivity [17]. There is great potential to increase agricultural production without additional investment and with existing technologies in developing countries [18]. Variables influencing changes in farm-level productivity include farmer education and experience, farm expansion, access to credit, and farm size [19]. An assessment of the impact of agricultural credit on rural farmers shows that unregulated private money lenders are a major source of credit, creating barriers to economic development [20]. The main constraints or challenges in accessing agricultural credit include high interest rates, bureaucratic hurdles, loan delays, and unnecessary requests for guarantors and collateral. To reduce these problems, the government and banks should try to create credit facilities and services adapted to the risk and cash flow patterns of the agricultural sector [21]. Even if additional investments are attracted in areas with unfavorable agriculture, the agricultural sector is considered inefficient. Nevertheless, due to low population density, industry should be supported by the state as the most important direction of rural development. In order to ensure social stability for regions that produce a significant amount of agricultural products, it is necessary to support the industry from the state. In order to increase the gross added value, it is necessary to conduct a policy of reducing the price disparity between agricultural and industrial products. In the most developed areas in terms of agricultural efficiency, the role of the state is to maintain their investment attractiveness,

as they use the available resources efficiently [22]. In the context of the integration of countries into the world economy, the agricultural sector is one of the priority and strategically important sectors of the national economy [23]. Therefore, the development of tools aimed at increasing the investment potential of this sector is an important component of the country's economic growth. As a result of the research, it can be noted that foreign direct investments have a negative impact on economic growth in developing countries. Further development of the investment potential of the country's agriculture ensures the radical acceleration of scientific and technical development and, on this basis, the reduction of the unit cost of agricultural products and food products, as well as the increase of their competitiveness in the domestic and world markets [24]. Agriculture can be affected by climate change, which has different effects on productivity depending on the crops grown and the farming systems used [25]. Agriculture in the region needs to adapt to a changing climate to maintain productivity and profitability, but this requires sustainable growth that does not compromise environmental quality and natural resources [26].

3 Research methodology

A quantitative research method is used to analyze the impact of agriculture on the regional economy, employment and export potential. The study uses secondary data from the statistics office and other relevant government agencies. In the study, regression and correlation analyzes were used to determine the relationship between agriculture and other economic indicators. The elasticity coefficient was also used to determine the impact of agriculture on the regional economy.

4 Analysis and discussion of results

The fact that agriculture is one of the main sectors of the economy and of special importance in the socio-economic development of the region was confirmed during our scientific research. Also, the fact that the share of agriculture in the gross regional product (GDP) remains almost unchanged, and the presence of stability in the development of the industry and its sectors serve to increase the impact of agriculture on the socio-economic growth of the region. The share of the industry in GDP was 66.89% in 2010, and by 2022 this figure has increased by 6.01% to 72.90%. The significant contribution of agriculture ensures that the impact on the growth of GNP will be large. In order to evaluate the influence of the network on GNP growth, a factor analysis was carried out. Data for the years 2010-2022 were used to perform this analysis, that is, indicators of the growth rate of GNP and industries and the share of industries in GNP. According to statistics, it can be seen that the growth trend of GNP in the next period has slightly decreased compared to previous years, that is, by 2022, it reached the lowest point of this period, making 2.3 percent. Because the quarantine measures that took place in our country due to the pandemic had a negative impact on the dynamics of economic indicators and led to a certain decrease. As a result, the growth trend has decreased in almost all sectors, and the impact of sectors on GNI growth has also decreased accordingly.

In Khorezm region, in 2010, the growth of GNI compared to the previous year was 7.1%, therefore, 6.5% was contributed by the gross added value of industries, and 0.6% by net taxes. In other words, 7.8% of the increase in GDP was provided by taxes, 92.2% by the growth in industries. By 2022, the total growth will be 2.3%, 2.2% will be provided by the gross added value of industries, and 0.1% by net taxes. Due to the reduction of the tax burden in the next period as a result of the reforms implemented in the budget and tax sphere, the impact of taxes on the growth of GNP also decreased. Overall, the impact of taxes on GDP growth will

decrease from 7.8 percent to 2.6 percent over the next 10 years [27]. On the other hand, the influence of the gross added value of the industries was 92.2 and 97.4 percent, respectively. It is noteworthy that even in 2022, it can be observed that the impact of agriculture on the growth of GNP was much greater. That is, if the GNP grew by 2.3%, then 1.4% fell on the agricultural sector. By this time, the impact of the pandemic has seen a decrease in the growth trend in all sectors, but the relatively small decrease in the level of growth in agriculture is the reason why its impact on GNP growth remains high. It can be seen that agriculture has a high impact on the growth of GNP in the region, but the fact that the production of agricultural products is connected with a number of environmental and climatic factors causes instability in its change. Conducting active practical work to reduce the effects of these factors will serve to ensure economic growth and stability in the region.

Table 1. Correlation coefficients between agricultural and main economic indicators.

	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}
X_1	1.00	-	-	-	-	-	-	-	-	-	-
X_2	0.99	1.00	-	-	-	-	-	-	-	-	-
X_3	0.99	0.96	1.00	-	-	-	-	-	-	-	-
X_4	1.00	0.97	0.99	1.00	-	-	-	-	-	-	-
X_5	0.58	0.65	0.50	0.55	1.00	-	-	-	-	-	-
X_6	0.74	0.64	0.80	0.77	-0.07	1.00	-	-	-	-	-
X_7	0.98	0.95	0.98	0.99	0.51	0.80	1.00	-	-	-	-
X_8	-0.50	-0.57	-0.43	-0.48	-0.65	-0.10	-0.42	1.00	-	-	-
X_9	-0.88	-0.81	-0.91	-0.90	-0.25	-0.92	-0.92	0.23	1.00	-	-
X_{10}	0.81	0.73	0.86	0.84	0.14	0.94	0.85	-0.11	-0.95	1.00	-
X_{11}	0.78	0.73	0.81	0.80	0.09	0.87	0.79	-0.26	-0.88	0.82	1.00

X_1 – real value of gross national product in billion soums, X_2 – real value of agricultural products in billion soums, X_3 – real value of industrial products in billion soums, X_4 – real value of rendered services in billion soums, X_5 - employment rate in percent, X_6 - unemployment rate in percent, X_7 - real total income per capita in thousand soums, X_8 - export volume in million dollars, X_9 - cotton fiber export volume in million dollars, X_{10} - food export volume in million dollars, X_{11} - the volume of exports of textiles and textile products in million dollars.

The significant share of agriculture in the GNP and its significant impact on socio-economic growth ensure its importance in the formation of the main economic indicators in the region and the elimination of social problems. We performed a correlational analysis to quantify and quantify these effects (see Table 1).

Data for the years 2010-2022 were used for this analysis, and the data in the form of values were transferred to real values, taking 2010 as the base year. According to the results of the analysis, the correlation between the amount of agricultural products and GNP is very strong, equal to 0.99. It can also be seen that the real value of agricultural output, the value of industrial output, and the volume of services provided are strongly related, and they are equal to 0.99 and 1.00, respectively. According to the correlation coefficients between population employment and GDP and economic sectors, it was found that the effect of increasing the volume of production in agriculture on employment is relatively high. However, on the other hand, the correlation coefficients between the level of unemployment

and economic sectors and the volume of GDP are also positive and have a sufficiently high value. The correlation coefficient between agriculture and unemployment rate is 0.64, which is smaller than others. In fact, there should be an inverse relationship between the level of unemployment and GDP and the volume of production in economic sectors. According to the results of our studies of this process, an increase in the level of unemployment along with economic growth was observed in the next period, and the existence of the underground economy and employment is considered as the main reason for this. If we focus on the relative analysis of indicators with a strong impact on the growth of real total income per capita and the size of the GDP, it can be seen that the influence of agriculture is relatively lower. Because the importance of industry and service in the sale of agricultural products and their transformation into products with high added value requires clarifying this process by looking at the value chain. However, the lack of sufficient statistical data to carry out analyzes in this direction is the reason why we use a simple method. In the next period, despite the fact that agriculture is considered as an important sector in increasing the export potential and changing the structure of the country and its regions, the results of the analysis revealed an inverse relationship between the total export volume and GNP and economic sectors in the region. According to the results of the study of this process, one of the main reasons for the origin of the disparity can be indicated above, the measures being implemented to change the composition of exports, i.e. to switch from the export of raw materials to the export of finished products. That is, it is caused by the issue of exportation of cotton fiber, which until now has a significant share in exports, to the world market, turning it into a finished product. As a result, there was a strong and negative correlation between the volume of cotton fiber export and the main indicators.

As a result of practical measures to increase the export potential of agriculture and change the composition of exports to products with high added value, the volume of exports of food and textiles and textile products is expected to increase in the next period. Also, in changing the composition of exports in these areas, it is necessary not only to develop agriculture, but also to develop industrial and service industries based on the deep processing of its products based on the development of the added value chain, as noted above.

The correlation coefficient between food exports and GDP is 0.81, showing a strong positive correlation. The influence of economic sectors is of particular importance in ensuring this relationship, and it was found that the correlation coefficient of food products in agriculture with the volume of production is 0.73, with the volume of industrial products is 0.86, and with the volume of services is 0.84. The same situation can be observed in the correlation coefficients between the export of textiles and textile products and the GNP and economic sectors, only the correlation with sectors other than agriculture is getting a slightly lower value. The results of the carried out correlation analysis prove that the influence of agriculture on the social and economic development of the region is very high, as well as its importance in the development of foreign economic activity. In addition, for the development of agriculture, it is necessary to develop the industry and service sectors accordingly. We will check the level of correlation between the mentioned indicators in exact numbers based on regression analysis.

First, we will look at the impact of changes in economic sectors on the volume of GDP. According to the results of the performed regression analysis, the following model was obtained.

$$\begin{aligned}
 GRP &= 346.7 + 1.3 * AGR + 1.2 * IND + 0.2 * SER & (1) \\
 se &= (132.1) \quad (0.11) \quad (0.28) \quad (0.08) \\
 t &= (2.62) \quad (11.55) \quad (4.23) \quad (2.53)
 \end{aligned}$$

Here: GRP - real value of gross regional product billion. in soums, AGR - the real value of the products created in agriculture billion. in soums, IND is the real value of the product

created in the industry billion. in soums, SER - the real value of the provided services is billion. in soums.

In order to verify the adequacy of the coefficients of the identified model, the results of the Student test were cited, and all the coefficients are higher than the table values. The coefficient of determination equal to 0.99 confirms that the selected influencing factors completely describe the total change in the outcome factor. According to Fisher's criterion, we can see that all coefficients are simultaneously adequate. Based on the results of the above criteria, we will use the model and draw conclusions. That is, an increase in the volume of agricultural production in the region by one billion soums ensures an increase in the volume of GDP by 1.3 billion soums. The change in industry and services will increase by 1.2 and 0.2 billion soums, respectively. It can be seen that agriculture is one of the most important sectors in increasing the amount of GNP in the region.

We have also developed a rank function to account for the above effects in terms of elasticity and growth rates, and it looks like this:

$$\begin{aligned} GRP &= 14.6 * AGR^{0.40} * IND^{0.18} * SER^{0.2} & (2) \\ se &= (0.21) \quad (0.04) \quad (0.03) \quad (0.03) \\ t &= (12.77) \quad (9.23) \quad (5.58) \quad (5.99) \end{aligned}$$

All the coefficients of this presented rank function are adequate according to the Student and Fisher criteria, and the coefficient of determination is equal to 0.99. The levels defined by this model represent the coefficient of elasticity. That is, a one percent increase in agriculture has the highest value, providing a 0.4 percent increase in GDP. An increase in the volume of industry and services by one percent, in turn, causes an increase in GDP by 0.18 and 0.20 percent. It can be seen that ensuring growth in agriculture is one of the most optimal ways to increase GDP.

Production and export of products in agriculture serves to increase the real income of the population. Regression analyzes confirm this opinion.

$$\begin{aligned} \ln(RINC) &= 1.05 * \ln(AGR) + 0.06 * \ln(FOODex) & (3) \\ se &= (0.004) \quad (0.014) \\ t &= (239.5) \quad (4.34) \end{aligned}$$

Here: RINC - real total income per capita in thousand soums, FOODex - export volume of food products in million dollars.

The volume of agriculture and food exports has a positive effect on the volume of real total income per capita, i.e. a one percent increase in the volume of production in agriculture ensures an increase in the volume of real total income per capita by 1.05 percent. However, the coefficient of elasticity between food exports and real gross income per capita has a positive value, but a very small amount. When the main reasons for this were studied, it was found that the system of processing agricultural products in the region is not well developed, as a result, the issue of exporting competitive products with high added value to the world market has not yet been resolved. In our opinion, the establishment of enterprises specializing in the deep processing of agricultural products will increase the level of profitability in agriculture and increase the real income of the population [28].

According to the results of the correlation analysis carried out above, there is a high correlation between the selected indicators, which limits the possibility of using multifactor models, causing the problem of multicollinearity in determining the influence of these factors. For this reason, we found it appropriate to consider separately the impact of agricultural production on the main socio-economic indicators of the region. We present the results of the regression analysis carried out in this direction (see Table 2)

Table 2. Regression analysis results.

#	Model	se	t-statistics	R ²	Coefficient of elasticity
1	$\lnAGR = 4.72 + 0.42\lnIND$	$b_1=0.2089$ $b_2=0.0324$	22.6 13.0	0.94	0.42
2	$\lnAGR = 4.82 + 0.35\lnSER$	$b_1=0.1566$ $b_2=0.0206$	30.8 16.71	0.97	0.35
3	\lnRINC $= -4.95 + 1.72\lnAGR$	$b_1=1.2005$ $b_2=0.1614$	-4.1 10.68	0.93	1.72
4	\lnFOODex $= -73.6 + 10.1\lnAGR$	$b_1=11.0884$ $b_2=1.4911$	-6.64 6.78	0.84	10.1
5	\lnFOODex $= -26.58 + 4.4\lnIND$	$b_1=4.1742$ $b_2=0.6482$	-6.37 6.74	0.83	4.4
6	\lnFOODex $= -25.64 + 3.6\lnSER$	$b_1=3.7053$ $b_2=0.4893$	-6.92 7.34	0.86	3.6
7	$EM = 8.71\lnAGR$	$b_1=0$ $b_2=0.0447$	0 194.8	0.99	0.087

It is known from Leontiv's inter-sectoral balance model that the development of economic sectors is directly related to each other, and it is impossible to achieve sustainable growth in the economy if their proportional development is not ensured. It is clear from this that in order to ensure sustainable growth in agriculture, it is necessary to ensure growth in industry and services, and vice versa. Taking this into account, the coefficients of elasticity were determined in order to assess the impact of industry and service sectors on the volume of agricultural production. According to the obtained results, a one percent increase in the production of industrial products in the region increases the volume of agricultural production by 0.42 percent. A change in the volume of services rendered provides a change of 0.35 percent.

The high share of agriculture in the GNP and the level of employment is the reason for its special importance in providing employment and income of the population. According to the results of the impact assessment analysis, a one percent increase in the volume of production in agriculture leads to an increase in real total income per capita by 1.7 percent. One of the promising directions is to increase the export potential of the region based on the transformation of the products grown into high added value while ensuring sustainable growth in agriculture. For this, it is necessary to ensure the appropriate development of not only agriculture, but also the industry that provides services to it and processes products. For this reason, the influence of sectors on food exports was considered based on the elasticity coefficient. According to the results, it was found that the coefficient of elasticity for the volume of agricultural production is very high and is equal to 10,1.

In addition, it can be observed that the influence of the volume of industry and service on the volume of export of food products is quite high, that is, the coefficient of elasticity for these is 4.4 and 3.6, respectively. One of the main reasons for having such high indicators is that in the next period, our government is paying special attention to this direction and ensuring a sharp increase in its indicators. In the last model, the relationship between the level of employment and the volume of agricultural production was considered, and the lin-log model was used, since the level of employment is in percentage and the volume of agricultural production is in value. Multiplying the coefficient determined by this model by 0.01 equals the coefficient of elasticity between the two indicators. The coefficient of

elasticity between the two indicators has a positive value of 0.087, but it is much smaller. Because the mechanization of agriculture and the development of industry and services ensure the transfer of the population employed in agriculture to these sectors. This serves to develop the system of storage and processing of agricultural products and to increase the created value. An increase in the impact of agriculture on the growth of GNP, especially in the context of a pandemic, has been observed. Also, the results of the correlation analysis confirmed that the development of other industries in the region, population employment and income, export potential are directly related to agriculture. The results of the regression analysis show that the coefficient of elasticity between GNP and the volume of agricultural products is equal to 0.4. It was found that the importance of agriculture in increasing the population's income and food export is very high, and the coefficient of elasticity between the indicators is large, i.e. equal to 1.7 and 10.1, respectively.

5 Conclusion

The study showed that agriculture plays an important role in the economic development of the region because of its high share in GDP and employment. The study found that an increase in agricultural production leads to an increase in gross per capita income and has a significant impact on food exports. Also, as a result of the study, it became clear that the development of other industries in the region, population employment, and income are directly dependent on agriculture. Therefore, it is necessary to ensure proper development of not only agriculture, but also the service and product processing industry. In order to increase the export potential of the region, it is necessary to pay attention to the conversion of the products to high added value, which requires the development of the system of storage and processing of agricultural products. The government should pay special attention to this direction and ensure a sharp increase in its indicators.

One of the promising areas of agriculture is the mechanization of agriculture, the development of industry and services, which will allow the population employed in agriculture to move to these sectors and create more value. In conclusion, the study showed that agriculture is a crucial sector in the economic development of the region. The development of other industries in the region, population employment, and income are directly related to agriculture. The government should pay special attention to this direction and ensure a sharp increase in its indicators. The study also suggests that agricultural mechanization and the development of industrial and service sectors can create opportunities for people employed in agriculture to move into these sectors and create more value.

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