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Empirical Analysis of Potato Production: in the Case of Samarkand Region, Uzbekistan

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ABSTRACT

In this research work, an economic assessment of the state of potato cultivation by farms and the factors affecting it was given in order to ensure the food security of the population. The analysis was based on the results of a social survey conducted in the farms of districts where potatoes are grown a lot in Samarkand region, using the OLS (Method of Least Squares) model. According to the results of the analysis, it was found that the age of the farm manager (*** p<.01) and cluster membership (** p<.05) have a negative effect on potato production in farms. However, the statistical significance of the work experience of the head of the farm (*** p<.01) and the presence of potato storage in the farm (* p<.1) is scientifically based. Based on the results of the analysis, scientifically based proposals and recommendations were developed.

INTRODUCTION

Uncertainties in international trade due to the increase in the world population, the pandemic, and the polarization of the countries of the world lead to an increase in the need for food and an increase in its prices. At the same time, feeding the expanding world population nutritiously and sustainably in the coming decades will require significant improvements in the global food system worldwide. One of the most important links in the value chain of potato farming is the link of direct product production. Potato production in our republic is mainly carried out by farms, peasant farms and agricultural enterprises. In the future, special attention is being paid to the development of clusters specializing in potato growing, and these clusters are not only involved in the production of potato products, but also seed supply, sale, storage and processing activities.

Development of potato growing in our republic and ensuring food safety in the "New Development Strategy of Uzbekistan for 2022-2026" adopted on January 28, 2022, as well as in the Decree of the President of the Republic of Uzbekistan on September 11, 2023 "On the strategy of Uzbekistan-2030". The decree envisages to increase the income of peasants and farmers by at least 2 times through the intensive development of agriculture on a scientific basis, to bring the annual growth of agriculture to at least 5%. In the program, the work of expanding the scope of state support and implementing new mechanisms of insurance was mentioned.

LITERATURE REVIEW

It is important to study the influence of direct production factors in the analysis of the value chain in potato farming. For this, we aimed to use the linear econometric model widely used by economists. Agricultural economics researchers have widely used this method to address their research questions, including (Sheng *et al.*, 2015), used a "fixed effects" model based on the Cobb-Douglas production function using panel data to estimate the effect of farm land area on their productivity. In their model, the farm output is taken as an arbitrary variable, while the arbitrary variables such as land, labor, capital and materials, which are factors of production, are given in logarithmic form. Also, (Kumbahar *et al.*, 2015) Cobb-Douglas described the issues of using a "fixed effect" model based on a production function in their work. By using cross-sectional data (Tadjiev *et al.*, 2023) measure the impact of production factors as well as the impact of farmers' participation in social media groups on cotton yield.

METHODOLOGY

Based on the above literature, in our scientific research, the impact on potato yield by applying the logarithmic (in order to reduce the size of some of the cited indicators and to facilitate the calculation of elasticity) and linear "mean least square" (OLS) model We evaluated the factors.

Survey data from Bulungur and Taylak districts were used for this research. Using survey data, we will analyze some socio-economic variables.

According to Figure 1, 7% of surveyed farms in Bulungur district have up to 1 hectare of potato cultivation area, and 17% have 2-3 hectares of potato cultivation area. 5 percent of respondent farms planted potatoes up to 4 hectares, and 20 percent of farms planted potatoes up to 5 hectares. Also, 7 percent of farms planted up to 6 hectares, more than 4 percent of farms planted up to 7 hectares, 8 percent planted 9 hectares, and more than 9 percent of farms planted more than 10 hectares. Also, we can see that 8 percent of the surveyed farms in Tailoq district grow potatoes on an area of up to 1 hectare, more

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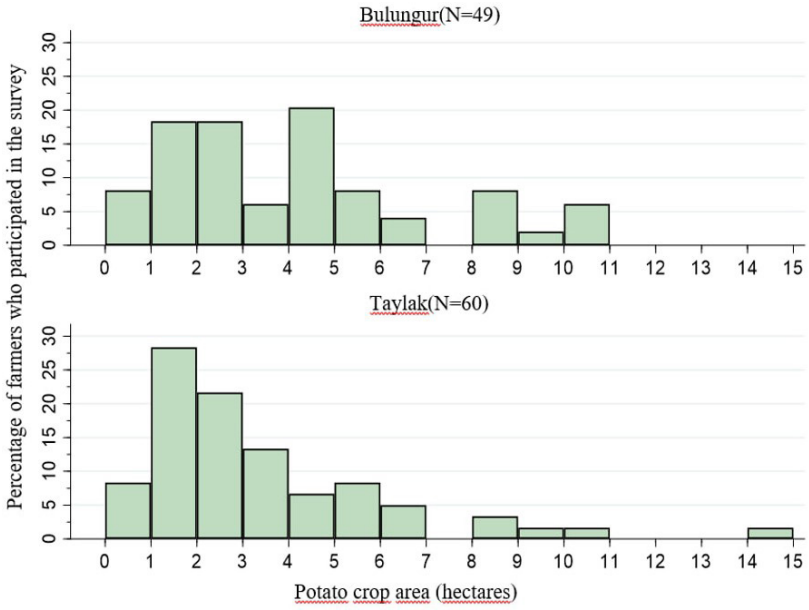

Figure 1: Potato crop area available to farmers in the surveyed areas

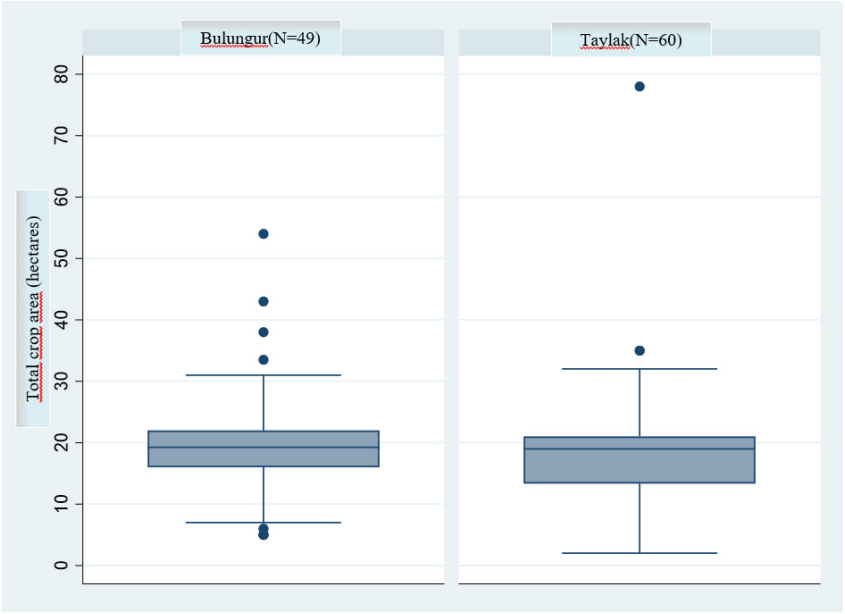

Figure 2: Land area available to farmers in the surveyed areas

than 27 percent of farms on 2 hectares, and 20 percent of farms on an area of up to 3 hectares. Other farms that participated in the survey in the district planted up to one hectare of potatoes.

As we can see in Figure 2, in 49 farms in Bulungur district, where the survey was conducted, land monkeys use an average of up to 20 hectares of land. Also, there are 2 farms with 10 hectares of cultivated land, and 2 farms with 30 to 40 hectares of cultivated land. There was 1 farmer with a land area of 40 to 50 hectares, and the number of farmers with a land area of 50 to 60 hectares was also. If we also analyze the land area of 60 farmers located in Taylak district, where the survey was conducted, farms with a land area of 15 to 20 hectares make up the majority of the farmers who participated in the survey, and only one farmer the cultivated area was more than 30 hectares.

According to Figure 3, according to the results of the survey in Bulungur district, more than 12 percent of the farms participating in the survey plant potatoes on 5 percent of the total cultivated area. More than 23 percent of the farms that participated in this survey occupied up to 15 percent of the total cultivated area with potatoes. In addition, 8 percent of farmers located in Bulungur district.

It was determined that potatoes are grown on 30-35% of the total cultivated land. Also, more than 3 percent of the farmers participating in this survey are planting potatoes on 75-80 percent of the total cultivated area. More than 12 percent of the farms that participated in the survey in Taylak district had 5 percent of the total cultivated area for potatoes.

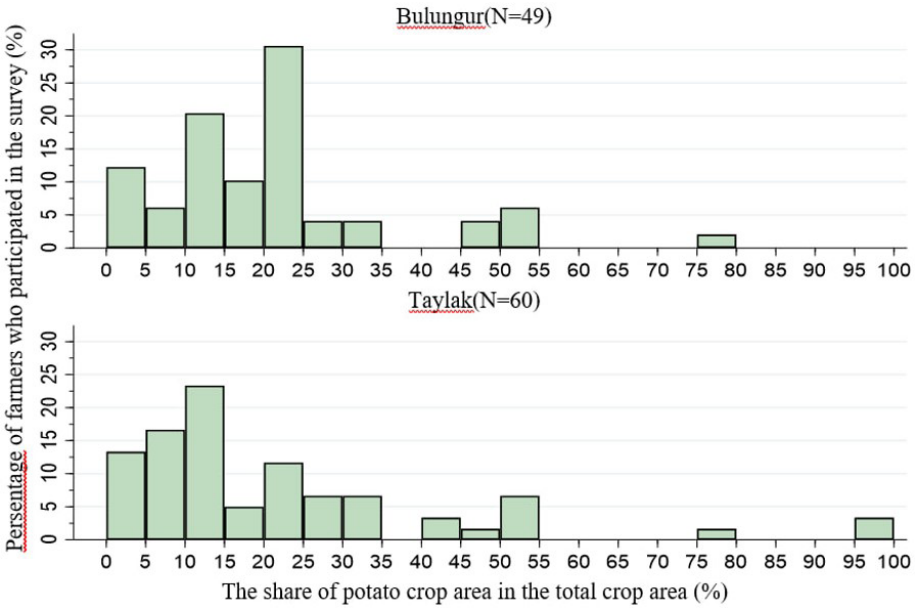

Figure 3: Potato crop area in total crop area (%)

Table 1: Status of cluster membership in potato production, %

Cluster membership status in potato production	Bulungur		Taylak	
	Total	%	Total	%
Number of farmers in the cluster	29	59.18	31	51.67
Number of farmers who are not members of the cluster	20	40.82	29	48.33
Total	**49**	**100.00**	**60**	**100.00**

Table 1 shows the percentage of farmers who are members of the cluster and who are not members in Bulungur district and Taylak district of Samarkand region, where we conducted a survey. We can see that 29 of the 49 farms that participated in the survey in Bulungur district, or 59.18% of the total, are cluster members, 40.82% of the 20 surveyed. We can see that 31 of the 60 farmers participated in the survey in Tayloq District, or 51.67% of the total. Number of farms that are not members of the cluster 29 out of 60 are not members of the cluster, which is 48.33 percent of the total.

In this Table 2, the requirements for potato seeds were studied in the farms of Bulungur and Taylak districts that participated in the survey. 42 out of 49 farms in Bulungur district participated in the survey, that is, 85% reported that they buy potato seeds of high reproduction every year, the remaining 7 or 15% have no demand for potato seeds. stated that 50 of the 60 farms that participated in the survey in Taylak District, or 83 percent, said that they needed high-quality potato seeds every year, and the remaining 10 farms, or 17 percent of those surveyed, did not need to buy potato seeds. they said.

Table 2: Availability of potato seed demand

Availability of potato seed demand	Bulungur		Taylak	
	Total	%	Total	%
There is	42	85.71	50	83.33
Not available	7	14.29	10	16.76
Total	**49**	**100.00**	**60**	**100.00**

This Table 3 provides an analysis of potato storage availability. 22 of the farms participating in the survey in Bulungur district or 45 percent stated that they have potato storage warehouses or use storage warehouses. 27 or 55 percent of farms do not have warehouses for storing potatoes. In Taylak district, this indicator is quite positive, and it was found that 83% of farms participating in the survey have storage warehouses, and the remaining 10 and 17% do not use storage warehouses.

In the research work, the following linear model was created to justify the scientific-methodical solutions within the scope of the goals and tasks set before the research by using the OLS (method of least squares) model in the analysis of the above questionnaire, and the available data were used.

Table 3: Availability of storage warehouse for potato products

Availability of storage warehouse for potato products	Bulungur		Taylak	
	Total	%	Total	%
There is	22	44.90	50	83.33
Not available	27	55.10	10	16.76
Total	**49**	**100.00**	**60**	**100.00**

$Y_i=\alpha_i + \beta_1 xk_{,i} +\cdots + \beta_{10} x_{k,i} +e_i$

Here

Y_i – voluntary variable, potato yield in our model (kg/ha);

Xk – (k=1...n) arbitrary variables;

x1 = age of the farmer

x2 = information of the farmer;

x3 =the farmer's experience;

x4= non-agricultural income;

x5=availability of state subsidies;

x6=extension service availability;

x7 =cluster membership;

x8 =availability of storage;

x9=distance to local bazar;

x10=distance to field;

x11=the number of workers;

x12=potato crop area;

x13=potato seeds;

x14=fuel consumption in potato cultivation;

b1… b14– means the coefficients of each variable, that is, the coefficients of the independent variables obtained from the regression results

ui = standard error

Statistical analysis of available variables using survey data is presented in the table below.

According to Table 4, the average age of the survey participants was 46 years, the youngest farmer was 26 years old, and the oldest farm manager was 69 years old. Also, the average cultivated area of the farms participating in the survey was 6 hectares, the minimum cultivated area was 2 hectares, and the maximum was 12 hectares. Farmers' education was found to be between high school and bachelor's level.

Table 4: Statistical analysis of variables (N=106)

Variables	Average	Standard deviation	Minimum value	Maximum value
Potato yield (kg/ha)	31764.15	9125.11	10000	60000
Age of farmer (years)	46.67	10,685	26	69
Cultivated area (ha)	5.868	1.639	2	12
Farmer's education (categorical, 1=no education….5=complete university)	3.387	0.562	3	5
Farmer's experience (years)	15.170	7.797	1	44
Non-agricultural income (binary)	0.273	0.448	0	1
Soil fertility (categorical 1=highly fertile…4=infertile)	2.745	0.663	1	4
Number of tractors (units)	1.198	0.920	0	5
Number of trucks (units)	0.255	0.518	0	2
Water pumps (units)	0.689	1.692	0	15
Credit service availability (binary, 1=available, 0=not available)	0.33	0.47	0	1
Availability of state subsidies (binary, 1=available, 0=not available)	0.047	0.213	0	1
Extension service availability (binary, 1=available, 0=not available)	0.038	0.191	0	1
Cluster membership (binary, 1=member, 0=not member)	0.557	0.499	0	1
Availability of potato seed demand (binary, 1=available, 0=not available)	0.840	0.369	0	1
Storage availability (binary, 1=available, 0=not available)	0.660	0.476	0	1
Distance to local market, km	22.061	21.112	1	80
Distance to the highway, km	11.216	14.111	0	80
Distance to field, km	1.529	1.693	0	11
Number of workforce	25,811	16.215	7	101
Potato crop area, ha	3.446	2.789	0.4	15
Potato seed, kg/ha	4170.755	561.158	3000	5500
Fuel consumption of potatoes, l/ha	134.057	58,644	40	300

Non-agricultural income is also important in farms, observations show that 27.3 percent of farmers in the surveyed areas have non-agricultural income, that is, taxi service, etc. among them.

The availability of credit service is also important in the activities of farms, and the observations showed that 33 percent of the farmers participating in the survey confirmed the availability of credit service.

RESULTS

The above table shows the results of the statistical analysis based on the survey data, i.e., the results using the OLS (method of least squares) model in the economic assessment of the factors affecting the yield of potatoes. Taking into account multicollinearity and other technical reasons in the model, we evaluated the effect of some factors, not all factors listed in the table above.

Table 5: Model results

Number of variables	**Coefficient**	**Standard error**
Age of farmer (years)	-320.048***	93.606
Farmer's education (categorical, 1=no education….5=complete university)	595.412	1616.521
Farmer's experience (years)	344.269***	128.175
Non-agricultural income (binary, 1=available, 0=not available)	3045.666	2035.313
Absence of state subsidies (binary, 1=available, 0=not available)	3151.502	4085.634
Extension service availability (binary, 1=available, 0=not available)	-282.55	4808.435
Cluster membership (binary, 1=member, 0=not member)	-3633.504**	1839.238
Storage availability (binary, 1=available, 0=not available)	3467.10*	1954.247
Distance to local market, km	5.353546	46.42359
Distance to field, km	344.1785	513.5499
Number of workforce,	-3.687671	54.39344
Potato crop area, ha	318.7353	364.0708
Potato seed, kg/ha	-1.419	1.555
Fuel consumption in potato cultivation, l/ha	-19.121	15.472
Number of followers	**106**	
R2	**0.25**	

Table 5 shows the results of the empirical model, that is, the analysis of the factors affecting the yield of potatoes, according to which we can see that as the age of farmers increases, the yield of potatoes decreases. One year of age of the farmer causes potato yield to decrease by 320 kg/ha. In conclusion, young farmers have a higher yield of potatoes than older farmers, and the use of new technology and quality seeds is faster in young farmers. This is directly related to the fact that young farmers are more inclined to adopt an innovative approach to potato production than older farmers, and use sustainable agricultural practices faster and more efficiently.

The experience of the farmer is also important for increasing the yield of potatoes, and the analysis showed that increasing the experience of the farmer by one year led to an increase in the yield of potatoes by 344 kg/ha. It is natural to have a high yield in potato cultivation.

Analyzing the effect of institutional factors on potato productivity, it is an unexpected result that cluster membership of farmers has a negative effect on potato productivity. According to the results of the model, if farmers are members of a cluster, their yield from 1 hectare of potatoes has decreased to 3.6 tons. Considering that clusters are now being formed in the region, there are problems related to contractual relations with them, interaction with the cluster and the farmer, and the supply of raw materials, fertilizers, and fuel (Kumbhakar, *et al.*, 2015).

In addition, when studying the effect of the presence of a storage warehouse from institutional factors, if farmers have such warehouses, their yield from 1 hectare of potatoes increases up to 3.5 tons. In general, the presence of a storage warehouse in the area will allow them to store potatoes for a long time, which will lead to the possibility of permanent potato income. The increase in income allows to carry out all agrotechnical activities on time, which in turn leads to an increase in productivity.

DISCUSSION

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CONCLUSION

The financial situation of potato farms shows that much work needs to be done as a result of the relationship between agriculture and consumers. The reason for this is the liberalization of the prices of material and technical resources (the cost of tillage equipment), fuels and lubricants and services, and the limitation of prices for fruit and vegetable products due to the monopoly status of processing, storage and trading enterprises (merchants occupying the markets). , it can also be explained by the low solvency of the population and the increasing cost of production units (including the low productivity of the land, the reason that most of the work is done by manual labor) .

The development of potato products should be one of the locomotives of economic reforms in our republic. At the moment, we see that the volume of investments in agriculture in our republic in the next 4 years is only 3-5 percent of the total investments in fixed capital. At the same time, world practice shows that it is difficult to achieve general economic development, including the growth of the industrial sector, without developing the agricultural sector.

Providing the population of our republic with cheap and high-quality food products should be carried out in conjunction with increasing soil fertility, improving rural infrastructure, giving a fair assessment to the products created by the farmer's forehead skin, and promoting it. This requires the government to provide serious financial support to agriculture and rural infrastructure, including the fruit and vegetable sector, and attract investments.

Currently, it is necessary to carry out systematic work on speeding up the process of deep processing of potato products, ensuring the financial and economic stability of production enterprises in this field, optimizing costs and reducing the cost of products. In this place, it is necessary to carry out work on the modernization of existing refrigerators, capacities of processing enterprises, including on the basis of public-private partnerships, and the introduction of international quality certificates in the production of products in the food industry. As a result of optimizing the production of horticultural products, it is possible to eliminate factors that negatively affect the activity of enterprises located in regions far from raw materials and lack of fruit products.

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