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PROSPECTS FOR THE DEVELOPMENT OF FRUIT AND VEGETABLE CLUSTERS

Abstract: In the article, the forecast of the republic's fruit and vegetable production for 2022-2027 is determined by creating an econometric model of parameter indicators, and sufficient conclusions and proposals are developed for the management and development of fruit and vegetable clusters.

Keywords: fruit and vegetable, cluster, forecast, productivity, management, mechanism, market, influence factors, income, mathematical model, profitability.

In order to effectively organize clusters in the field of fruit and vegetables and to continue their activities for a long time, it is necessary to introduce innovative technologies in their activities. It is important to focus on the creation and implementation of innovations in all links of the cluster. Currently, clusters rely more and more on technologies that are being sought from abroad. Studies show that this method is ineffective. Fruit and vegetable clusters are highly effective in finding and introducing innovations suitable for our regions and climate. Finding methods and directions that have no equivalent in any country in the world and implementing them in effective ways will ensure our competitive advantage.

According to the Decree of the President of the Republic of Uzbekistan No. PF-5853 dated October 23, 2019, by 2030, annual growth of value added in agriculture by 5%, increase in the volume of exports of agricultural and food

products by 20 billion US dollars and increase of labor productivity in agriculture from 3,960 US dollars to 6,500 US dollars per worker in one year.

Under such circumstances, under the influence of the process of modernization of production, such tasks as forecasting the system of growing fruit and vegetable products in advance, forecasting the future increase in productivity and the state of growth in the volume of production become more and more relevant. It should be noted that the development of the fruit and vegetable sector depends on many factors. Therefore, among a number of economic analysis methods, the use of mathematical modeling methods makes it possible to accurately assess the dynamics of development, including the factors affecting it.

Based on the complete study of each form of management, location, social division of labor, geographical (territorial) division, and the ability to use available resources, specific features of production arise in the fruit and vegetable industry. In general, it shows the distribution of fruit and vegetable production by regions based on certain principles and according to the natural, social, demographic, and political conditions formed under the influence of a number of factors.

According to the scale of forecasting, it is divided into macroeconomic and microeconomic forecasts. There are two types of approaches to forecasting: exploratory and normative. Various options and methods of forecasting the volume of production can be used in scientific literature. R.F.Djumanova in her researches stated that there are 130 different methods of forecasting, according to which they can be conditionally divided into 3 important groups in forecasting. They consist of extrapolation method, expert assessment method of forecasting and modeling methods.

In the above chapters of our research, we have considered that the growth of productivity in agriculture and horticulture is of great importance from both the microeconomic and macroeconomic point of view. The question of increasing the level of productivity through rational use of land areas and efficient allocation of

resources is an urgent issue. Therefore, it is necessary to evaluate the influence of factors in increasing the level of productivity, to perform econometric modeling based on the analysis of statistical indicators.

Taking this into account, in our study we considered it desirable to conduct an econometric analysis of the influence of factors on the productivity of vegetable products and fruit products. First, we will analyze the influence of factors on the level of productivity of vegetable products. We put forward a theoretical hypothesis that the productivity level of vegetable products is theoretically influenced by the cultivated area, seed consumption, labor consumption, the number of used equipment, the amount of fuel, lubricants, and the amount of mineral fertilizers used. In our analysis, we use the statistical indicators of the productivity level of vegetable products in Uzbekistan and the resources used for the cultivation of vegetable products for the years 2007-2021. The yield index presented in this appendix is obtained in the form of 1 centner of fruits obtained from 1 hectare, The crop area taken as a factor influencing the productivity level is in units of thousand hectares, the number of machines is in pieces, the other factors are seedling consumption, labor consumption, consumption of fuel, lubricants, consumption of mineral fertilizers are given in nominal amounts (in current prices). We can transfer current prices to comparable amounts.

Descriptive statistics of the indicators used in our study are presented in Table 1 below. In the table, the indicators are presented with the following symbols: P – productivity, CA – crop area, NT – number of techniques, SC - seed consumption, LC – labor cost, CFL – consumption of fuel and lubricants, CM – consumption of mineral fertilizers.

It can be seen from the descriptive statistics of the data, In this study, the lowest amount of productivity was 213.3 ts for hec., and the highest was 254.8 ts for hec., the minimum amount of labor expenditure was 3036.9 thousand soums, the maximum amount was 4086.8 thousand soums, the minimum amount of fuel

and lubricants was 533.3 thousand soums, the maximum amount was 1456.7 thousand soums.

Table 1

Descriptive statistics of the level of productivity of vegetable products in Uzbekistan and the factors affecting it

Indicator	Average	Median	Minimum	Maximum
P	238,57	239,30	213,30	254,80
CA	192,01	189,70	159,80	227,10
NT	11063,	12312,	6123,0	14794,
SC	1451,8	1484,2	1051,2	1834,4
LC	3590,5	3674,0	3036,6	4086,8
CFL	946,25	887,10	533,30	1456,7
CM	1128,3	1173,7	937,80	1293,8
Indicator	**Standard deviation**	**Variation**	**Asymmetry**	**Excess**
P	11,761	0,049298	-0,51938	-0,47744
CA	22,688	0,11816	0,17373	-1,2340
NT	2948,6	0,26653	-0,60010	-1,2499
SC	244,21	0,16821	-0,25725	-1,0257
LC	328,10	0,091380	-0,22951	-0,99617
CFL	333,66	0,35261	0,17843	-1,4976
CM	109,67	0,097196	-0,35882	-1,0399

Note: Calculations were calculated in the Gretl software package.

At the initial stage of our analysis, based on the data of Table 3.3.1, the level of productivity of vegetable products (P) with CA - cultivated area, NT - number of technics, SC - seed consumption, LC - labor consumption, CFL - fuel lubricant consumption, CM - mineral fertilizer consumption we analyze the correlation coefficient (Table 2).

Table 2

Correlation matrix between the level of productivity of vegetable products in Uzbekistan and the factors affecting it

P	CA	NT	SC	LC	CFL	CM	Factors
1,0000	0,7060	-0,6020	-0,7048	0,8975	0,8860	0,9251	**P**
	1,0000	-0,8768	-0,9564	0,6444	0,8342	0,7787	**CA**
		1,0000	0,9591	-0,4383	-0,7714	-0,6296	**NT**
			1,0000	-0,5883	-0,8265	-0,7369	**SC**
				1,0000	0,8125	0,9612	**LC**

					1,0000	0,9177	**CFL**
						1,0000	**CM**

Note: Calculations were calculated in the Gretl software package.

Based on the correlation matrix, we select indicators that are suitable for modeling. In our analysis, we take the total investment activity indicators of commercial banks as a result indicator. The correlation coefficient is an important indicator of how much one factor affects the change of another factor, and it varies between -1 and 1. If the indicator is between 0 and 1, the factor sign is positive for the resulting sign change, and if it is between -1 and 0, the factor sign represents the opposite effect on the resulting sign change. The closer the correlation coefficient is to 1 or -1, the stronger the relationship. In order to continue the analysis, we need to choose factors with a correlation coefficient higher than 0.7 or lower than -0.7, because in this case, it means that the factors have a strong influence on the resulting sign. It can be seen from Table 2 that among the factors obtained in our hypothesis, the ones with the strongest correlation with P - productivity level are LC - labor costs (0.8975), LC - fuel lubricants costs (0.8860), CM - mineral fertilizers costs (0.9251) , we will use the indicators of these factors in the next stage of our analysis to create a regression model (Table 3).

Table 3

The regression equation of the level of productivity of vegetable products in Uzbekistan and the factors affecting it

Factors	Coefficient	Standard error	t-statistics	P-value	Confidence level
const	155,896	17,9388	8,690	<0,0001	***
LC	0,0187428	0,00620321	3,021	0,0106	**
CFL	0,0162555	0,00609990	2,665	0,0206	**
Dependent variable mean		238,5733	Standard deviation		11,76128
Sum of Squares of Residuals		236,5346	Standard error		4,439732
R-squared		0,877860	Adjusted R-squared		0,857504
F-statistics (2, 12)		43,12404	R-value (F)		3,32e-06
Logorithmic closeness to truth		−41,96941	Akaike criterion		

			89,93882
Schwartz criterion	92,06297	Hanna-Quinn criterion	89,91619
Rho parameter	−0,083741	Darbin-Watson statistic	1,879906

Note: Calculations were calculated in the Gretl software package.

****** Statistically significant at 1% significance level, ** Statistically significant at 5% significance level, *Statistically significant at 10% significance level.***

We selected the optimal regression equation for ourselves by performing the analysis using the method of least squares. Here labor cost (LC) and fuel lubricants (CFL) were taken as dependent variables. Inductive analysis of the model. The value of the Fisher-Snedekor F-criterion in the model is less than 0.05, so the model is statistically significant. The statistical significance of the obtained independent variables (labor cost (LC) and fuel lubricants (CFL)) was confirmed to be less than 0.05 and statistically significant when tested by Student's t-test. Therefore, this model is suitable for use in inductive analysis.

Interpretive analysis of the model.

$$P = 155{,}896+0{,}0187428\ LC +0{,}0162555YMM +e \quad (1)$$

Here:

LC – Labor costs for 1 hectare of land, in soums;

CFL –Fuel lubricants spent on 1 hectare of land;

const– initial value;

e – factors not taken into account.

The coefficient of determination of the created equation is equal to 0.8575, and 85.75 percent of the change in the yield level of vegetable products can be explained through the created model. According to the correlation coefficient, the independent variables of the model are correctly related.

The coefficient in front of LC (0.0187428) - when other factors remain

unchanged, an increase (decrease) in labor costs by 1 (one) thousand soums leads to an increase (decrease) in productivity by 0.0187428 centners. The coefficient in front of CFL (0.0162555) - when other factors remain unchanged, an increase (decrease) in the consumption of fuel lubricants by 1 (one) thousand soums leads to an increase (decrease) in productivity by 0.0162555 centners.

The field of horticulture is also considered an important branch of agriculture in Uzbekistan, and increasing the efficiency of this field is gaining urgent importance today. From this point of view, we found it permissible to carry out our econometric analysis in the field of fruit growing as well.

We make a theoretical hypothesis that the yield of fruit products is theoretically affected by the area of the crop, the amount of seedlings, the amount of labor, the number of used equipment, the amount of fuel, lubricants, and the amount of mineral fertilizers. In our analysis, we use the statistical indicators of the level of productivity of fruit products in Uzbekistan and the resources used for growing fruit products for the years 2007-2021 (Appendix 3). The productivity index presented in this Appendix 1 is obtained in the form of the expression of vegetables in 1 hectare, The crop area taken as a factor influencing the productivity level is in units of thousand hectares, the number of machines is in pieces, the other factors are seedling consumption, labor consumption, consumption of fuel, lubricants, consumption of mineral fertilizers are given in nominal amounts (in current prices). Of course, since these indicators are at current prices, it would be unreasonable to compare them with each other, therefore, in order to make a more accurate conclusion, we can transfer the nominal amounts from the consumer price index indicators of different years to the comparable amounts in 2021.

Descriptive statistics of the indicators used in our study are presented in Table 4 below. The indicators are presented in the table with the following symbols: P – Productivity, CA – cultivated area, NT – number of technics, SC – seedling consumption, LC – labor consumption, CFL – consumption of fuel

lubricants, CM – consumption of mineral fertilizers.

Table 4

Descriptive statistics of the level of productivity of fruit products in Uzbekistan and factors affecting it

Indicator	Average	Median	Minimum	Maximum
P	108,41	116,00	76,600	134,50
CA	270,62	261,90	214,90	347,20
NT	12141,	12312,	10103,	13276,
SC	6573,9	6881,5	5347,7	7610,3
LC	3456,9	3610,0	1933,7	4694,3
CFL	599,90	562,60	338,20	923,80
CM	722,45	717,10	638,50	823,40
Indicator	**Standard deviation**	**Variation**	**Asymmetry**	**Excess**
P	17,366	0,16019	-0,45879	-0,94575
CA	44,451	0,16426	0,54119	-1,0055
NT	937,93	0,077255	-0,72125	-0,40775
SC	719,24	0,10941	-0,35255	-1,1690
LC	805,97	0,23315	-0,40477	-0,84825
CFL	210,29	0,35054	0,19605	-1,4875
CM	55,927	0,077413	0,078664	-0,90021

Note: Calculations were calculated in the Gretl software package.

It can be seen from the descriptive statistics of the data, In this study, the lowest amount of productivity was 76.6 ts for hec., and the highest amount was 134.5 ts for hec., the minimum labor cost was 1933.7 thousand soms, the maximum amount was 4694.3 thousand soms, the minimum cost of fuel and lubricants was 338.2 thousand soms, the maximum amount was 923.8 thousand soms.

Table 5

Correlation matrix between the productivity level of fruit products in Uzbekistan and the factors affecting it

P	CA	NT	SC	LC	CFL	CM	Indicators
1,0000	0,7119	-0,3191	0,9832	0,9598	0,8765	0,9326	**P**
	1,0000	-0,6235	0,7102	0,5453	0,7832	0,4416	**CA**
		1,0000	-0,2392	-0,1336	-0,1421	-0,0595	**NT**
			1,0000	0,9622	0,9276	0,9396	**SC**
				1,0000	0,8309	0,9759	**LC**

					1,0000	0,7943	**SFl**
						1,0000	**CM**

At the initial stage of our analysis, based on the data of table 4, the correlation of fruit productivity level (P) with CA - cultivated area, NT - number of technics, SC - seedling consumption, LC - labor consumption, CFL - fuel lubricant consumption, CM - mineral fertilizer consumption we analyze the coefficient (Table 5).

In the correlation matrix, SC - seedling consumption (0.9832), LC - labor consumption (0.9598), CFL - fuel lubricant consumption (0.8765) and CM - mineral fertilizer consumption (0.9326) we see that it is are mutually strongly related. Therefore, we create the interaction of these factors with the level of productivity by modeling the optimal regression equation.

Table 6

Regression equation of productivity level of fruit products in Uzbekistan and factors affecting it

Factors	Coefficient	Standard error	t-statistics	P-value	Confidence level
const	40,0728	5,55573	7,213	<0,0001	***
LC	0,0161106	0,00270562	5,954	<0,0001	***
CFL	0,0210828	0,0103698	2,033	0,0648	*
Dependent variable mean		108,4133	Standard deviation		17,36634
Sum of Squares of Residuals		247,3714	Standard error		4,540296
R-squared		0,941413	Adjusted R-squared		0,931648
F-statistics (2, 12)		96,41095	R-value (F)		4,04e-08
Logorithmic closeness to truth		−42,30538	Akaike criterion		90,61077
Schwartz criterion		92,73492	Hanna-Quinn criterion		90,58814
Rho parameter		0,235016	Darbin-Watson statistic		1,353566

Note: Calculations were calculated in the Gretl software package.
**** Statistically significant at 1% significance level, ** Statistically significant at 5% significance level, *Statistically significant at 10% significance level.*

We have chosen the optimal regression equation for ourselves by performing the analysis using the method of least squares (Table 6). Here labor cost (LC) and fuel lubricants (CFL) were taken as dependent variables. Inductive analysis of the model. The value of the Fisher-Snedekor F-criterion in the model is less than 0.05,

so the model is statistically significant. The statistical significance of the obtained independent variables (labor cost (LC) and fuel lubricants (CFL)) was confirmed to be less than 0.05 and statistically significant when tested by Student's t-test. Therefore, this model is suitable for use in inductive analysis.

Interpretive analysis of the model.

$$P = 40{,}0728+0{,}0161106\ LC +0{,}0210828\ CFL +e \quad (2)$$

here:

LC – Labor costs for 1 hectare of land, in soums;

CFL –Fuel lubricants spent on 1 hectare of land;

const– initial value;

e – factors not taken into account.

The coefficient of determination of the created equation is equal to 0.9316, and 93.16 percent of the change in the yield level of fruit products can be explained through the created model. According to the correlation coefficient, the independent variables of the model are correctly related.

The coefficient in front of LC (0.0161106) - when other factors remain unchanged, an increase (decrease) in labor costs by 1 (one) thousand soums leads to an increase (decrease) in productivity by 0.0161106 centners. The coefficient in front of CFL (0.0210828) - when other factors remain unchanged, an increase (decrease) in the consumption of fuel lubricants by 1 (one) thousand soums leads to an increase (decrease) in productivity by 0.0210828 centners.

Table 7

2022-2027 forecast indicators of the influence of factors on the level of productivity of vegetable production

Years	Productivity index (ts.hec)	Labor cost (thousand soums)	Fuel lubricants (thousand soums)
2022	249,8	3510,0	1221,8
2023	251,9	3952,3	1287,1
2024	253,9	4004,0	1352,4
2025	255,9	4055,7	1417,7
2026	258,0	4107,4	1483,0

2027	260,0	4159,1	1548,3

The productivity index in 2022 will be 249.8 ts.hec, it is predicted to be 10.5 ts.hec or 4.4% more than the indicator in 2021. This increase is influenced by the increase in labor costs and fuel and lubricants consumption forecasts in 2022 by 12.6 and 6.8 percent from 2021. It can be seen from Table 3.3.7 that in 2022-2027, indicators of labor costs and GDP will increase regularly, which creates the basis for a stable growth trend of productivity indicators in these years. In particular, according to the forecast, the yield in 2027 will be 8.6% higher than in 2022.

Based on the forecast indicators, we show the forecast indicators on the influence of the factors of fruit productivity level in Table 8.

Table 8

Forecast indicators of the influence of factors on the level of productivity of fruit growing in 2022-2027

Years	Productivity index (ts.hec)	Labor cost (thousand soums)	Fuel lubricants (thousand soums)
2022	124,6	3450,0	761,3
2023	127,5	4247,8	802,1
2024	130,5	4378,8	842,9
2025	133,5	4509,9	883,8
2026	136,4	4640,9	924,6
2027	139,4	4771,9	965,5

The productivity index in 2022 is 124.6 ts.hec, it is predicted to be 5.3 ts.hec or 4.4% more than the indicator in 2021. This increase is influenced by the increase in labor costs and fuel and lubricants consumption forecasts in 2022 by 23.1 and 7.1 percent from 2021. It can be seen from Table 8 that in 2022-2027, indicators of labor costs and GDP will increase regularly, which creates the basis for a stable growth trend of productivity indicators in these years. In particular, according to the forecast, the yield in 2027 will be 16.9% higher than in 2022.

In conclusion, the production of fruit and vegetable products in our country is predicted to reach 139.4 centners per hectare and 260 centners per hectare in

vegetable cultivation by 2027 under the influence of various factors, we can see that the volume of fruit production will increase by 1.16 times in 2027 compared to 2021, and the volume of vegetable products by 1.09 times. It can be concluded that as a result of the increase in the population over the years, we will be able to achieve an increase in the volume of fruit and vegetable production.

Over the years, the following main directions for the future development of fruit and vegetable clusters and increasing their income have been identified. In this:

✓ to expand the land and water areas at the disposal of fruit and vegetable clusters, if this is not possible at all, to maximize productivity by introducing modern intensive technologies, seedlings and seed varieties suitable for our climate;

✓ to create all opportunities for clusters to grow products, to find solutions to the problems that have persisted in fruit and vegetable production for years, and to achieve a positive result in the future by improving credit mechanisms;

✓ to create an opportunity to properly set up the mechanism of production, storage, processing and sale of products on the basis of all types of farms specializing in fruit and vegetable growing.

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1. Decision of the President of the Republic of Uzbekistan dated January 28, 2020 No. PQ-4575 "On measures to implement the tasks set in the strategy for the development of agriculture of the Republic of Uzbekistan for 2020-2030 in 2020".

2. Decision No. 102 of the Cabinet of Ministers of the Republic of Uzbekistan dated February 19, 2020 "On additional financial support measures for horticulture and greenhouse farms and fruit and vegetable clusters".

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