Management and Modeling of Processing Of Agricultural Products in Kazakhstan

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***Abstract* — The article is devoted to important aspects of the development of agro-industrial complex of Kazakhstan. The contribution of agriculture to GDP is still relatively low, averaging less than 5% in recent years. However, a positive trend is planned at the expense of state support for the development of this sector. The country has received insufficient development of the processing sector of food production. It is noted that this is due to a greater extent due to low domestic prices and advantageous terms of trade in foreign markets. The work carried out econometric modeling assessment of factors that have a significant importance for the development of agricultural product processing areas on the example of the light industry. Based on regression analysis revealed that the increase in the yield of major crops and the flow of investment will lead to increased production in agriculture. Revealed problems and provides recommendations to improve the organization of the processing industry of the agricultural sector.**

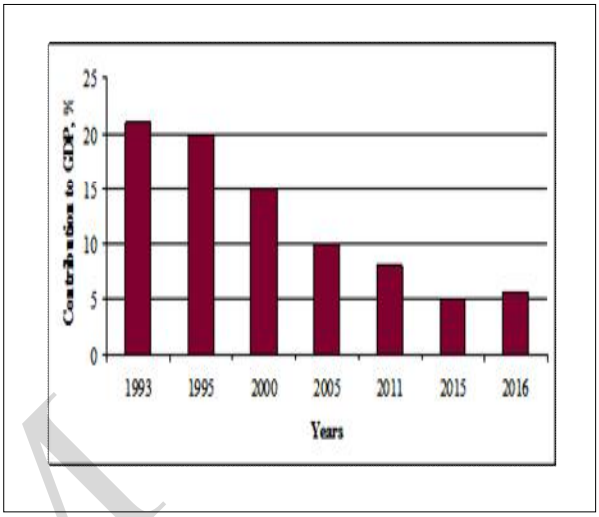
***Index Terms* — Kazakhstan, processing of agricultural products, food security, light industry, cotton, investment, econometric modeling**

I. INTRODUCTION

The growth of the population in the world, respectively, increased demand for agricultural products dictate the expediency of supporting measures to improve agricultural policy and increase food production throughout the world economy.

The entry of Kazakhstan into the WTO in 2016 promotes the solution of agricultural producers to improve the competitiveness of agricultural products. Kazakhstan has great potential for agricultural production - due to the large area and favorable climatic prerequisites, especially in the southern regions of the country. In addition, there is the proximity to the largest markets importing products of light industry (Russia, China, and India).

According to the Ministry of Agriculture of Kazakhstan - in 2015 the value of gross agricultural output increased by 4.4%. However, it remains a relatively modest figure for the economy of agribusiness development in the Republic of Kazakhstan. For example, if the share of the AIC's contribution to gross domestic product was in 1993. - More than 20% (Fig. 1), then at the beginning of 2017 the year - 5.5%.



A. Source: Committee on Statistics of the Ministry of National Economy of Kazakhstan: www.stat.gov.kz

Fig. 1. The share of agriculture's contribution to the Gross Domestic Product of Kazakhstan

However, there is the formation of Kazakhstan on imports for many types of products AIC processing. The Republic of Kazakhstan is the third largest grain producer in the CIS after Russia and Ukraine. One of the main sources of foreign exchange earnings in the country's economy is the export of wheat. Despite the fact that the country is in the zone of risky agriculture, and grain harvest may differ by more than 50% in different years, Kazakhstan is self-sufficient in corn, and exports at least 70% of the harvest, even in the lean years.

II. EVALUATION OF PROCESSING SECTOR IN AGRICULTURE

The ability of countries to provide themselves with their own food can be one of the indicators of economic security. Major sector of agricultural production of Kazakhstan is the crop. This sector accounts for about 58% of the total production in agriculture. The second most important sphere - is breeding. This area is about 42% of the total output of the agricultural sector. Widely developed livestock industries such as sheep and cattle, which accounted for 65% of meat produced in the country.

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In the food industry fixed capital investment increased by 28%, while the volume of investments into fixed capital in agriculture decreased by 6.3%. Currently, products are produced in agriculture is sold as a raw material is not recycled, which is about 80%, and finished products takes weak competitiveness due to technological underdeveloped processing enterprises.

To date, these agribusiness industry as processing and storage occupy a significant place in the world and in the domestic economy. Seasonality of agricultural production implies to store the products so as to apply it in the long term. The development of the processing industry in the agro-industrial complex is a priority task for the implementation of the country's food security.

Kazakhstan has developed the State program of development of the agricultural sector in the years 2017-2021. It notes that currently recycled less than 30% of meat, milk, fruits and vegetables, with loading capacity of 403 processing enterprises in the country is only 20-60%.

The main alternative to the market conditions considered to increase the quality of agricultural products in the field of storage and processing. Processing agricultural importance include that processing of high quality raw materials are available on most of the full products than when processing lower quality feedstock's. The quality of the number of saves. Quality Score - is an essential lever, as it increases the efficiency of production activities.

In any country, the level and quality of the food security depends directly on the state of agriculture and related industries of agriculture. During the processing of agricultural products in agribusiness use technology that is related to the type of raw material, with emissions up to 50%. For effective feed content, reduce emissions. But it is impossible to completely remove all the waste.

During the processing of fruits and vegetables, it is impossible to avoid emissions in the form of skins, grain, son, sprouts, and seeds. These seeds have a useful substance. The form of processed products is considered an important sign of the level of waste. In order to avoid or minimize the waste of high importance is the rational and judicious use of raw materials in the complex processing. Thus, from a single type of raw material to produce several types of products, and waste produced at the same time, are used to form useful products or fed their livestock.

However, the low profitability of the agricultural industry, the low level of renewal of fixed assets industry processing and storage, the lack of investment resources - all this dictates the use of effective methods of administrative-legal regulation of AIC. The main types of produced and exported products is agricultural raw materials, low gross value added. While all developed countries trade and export ready-made food products. Thus receive greater profits.

In accordance with agro-technical regulations in Kazakhstan for all acreage necessary to make each year to 1.8-1.9 mln. Tons of mineral fertilizers in bulk. However, each year is used up to 500 ths. tons of mineral (nitrogen and phosphate) fertilizer, which is insufficient production factor in the development and processing of agricultural products.

There is a problem due to the lack of domestic production of ingredients - vitamins, enzymes, amino acids - for the production of animal feed. Therefore, they are expensive imports affect the rise in price of feed, making them accessible to the majority of small agricultural enterprises. Application of new technology increases crop yields, improves the fertility of the land, the construction of innovative processing warehouses, silos and mills a positive impact on the preservation of the crop and the possibility of its implementation abroad. Consequently, there is a question about the appropriateness of the modernization of agricultural production, processing industry and agribusiness storage system of Kazakhstan..

III. LITERATURE REVIEW

Scientists Oosterveer and Sonnenfeld (2011) substantiated the important role of state regulation of the agrarian sector of the processing sector to ensure food security in the context of globalization. Organization of the food market characterizes the level of sustainable development of the country [1].

For the purpose of an objective assessment based on the econometric analysis carried out the selection of the impact of significant factors. Indicators are expressed on a comparable basis, logarithmic, the estimate time series stationarity based on the autocorrelation function [2].

Maxwell and Gittinger (2014) define the need for development of light industry on the example of the textile processing. Organization of the textile sphere is based on the production of cotton, production of a wide range of apparel products [3].

According to Myrdal is very essential in the organization of infrastructure, including in the field of agriculture has a beneficial effect on the development of the national economy [4].

It is noted that the problems of the development of processing industries associated with underdeveloped infrastructure and high wear and tear of production assets of agricultural enterprises in Kazakhstan. In addition, stress Smagulova and Radko (2015) that the local farmers do not have enough investment and the lack of collateral base for the purchase of new equipment [5].

A certain importance for the development of the processing sector have a co-operative organizations in the agricultural sector. There are prerequisites for optimal utilization of material resources and reduce the costs of joint production of agricultural companies. Patrick and Nellis argue that the increase in investment in agriculture provide the content, not only domestic but also foreign markets food products [6].

Serdobintsev, Matveeva and Sorokina (2014) involved with the organization of the state of cluster policy in foreign countries. Important attention is paid to the study of the scope of the storage, processing and marketing of agricultural products. A certain emphasis is placed on evaluating statistical data on the development of clusters in Europe. The analysis of

cluster projects in Russia. Offered prospects of cluster activities at the regional level [7]. The above survey shows the importance of the sphere of processing of agricultural products.

IV. MODELING AND PROCESSING OF LIGHT INDUSTRY GOODS

Today in the world there is a steadily growing demand for these types of goods, such as cotton yarn, cotton fabrics, and woolen jerseys. The country has the necessary conditions for the creation of the resource base and cotton cultivation.

However, for more than 20 years the development of light industry has been steadily decreasing. So, if in 1993 the share of light industry in the total industrial production was 19%, in 2015 it fell to 2%. Light industry of Kazakhstan has a complex structure, including three groups: industry - textile, clothing and leather products, which account for about 50%, 41% and 9% respectively of release.

South-Kazakhstan region - the only region in the space of the Eurasian Union, where cotton is grown. A feature of the light industry is that it is technologically very closely linked to the agro-industrial complex and the chemical industry. This area in the future has great potential for increasing the production of high-quality cotton fiber per year to 110-120 ths. tons, of which can produce more than 73 thousand. Tons of high quality yarn and produce 891 million square meters of cotton cloth.

The main cotton producers are peasant / farmers with land holdings of 5 to 10 hectares of land. And this is very little to maintain the efficiency of production, i.e., to comply with all the necessary agro-technical measures to increase productivity and achieve quality cotton. Greatly reduced amounts of mineral fertilizers, is not carried out the necessary rotations. Producers of raw cotton financed ginneries. If in 1998 there were 14 factories in the Republic of Kazakhstan for the processing of raw cotton, more than 25 in 2016.

Cotton processors have become the main monopoly on the cotton market, which began to dictate the purchase price. Over 90% of the resulting cotton fiber plants for export and domestic consumption were less than 10%. Many textile enterprises were idle due to lack of raw materials and depreciation of equipment. In this regard, the Government of Kazakhstan has begun to take a number of concrete measures to restore and revive the cotton textile industry. One of which is the allocation of subsidies to cotton producers, tightening expenditure control.

It is estimated that the production of yarn and fabrics accounted for about 80% of the final marketable value-added products, at the same time as the production of cotton fiber about 10% and production of finished garments 1-3%. From the export of finished products (yarn and fabric) main countries-exporters of cotton products are paid at 8 times the income of cotton fiber exports. One of the reasons for the low load plants is the low level of technology and worn equipment.

Actual problems of development of cotton-textile industry of Kazakhstan is the creation of optimal closed cycles of production of high-quality cotton to production of finished products on the basis of cooperation and integration. To this end, it is necessary to upgrade the existing cotton plants using the latest technology.

V. DATA AND METHODOLOGY

In order to determine which factors have the greatest impact on the level of processing of light industry in Kazakhstan, it was built multiple regression model. For the econometric analysis in the used statistics from 1993 to 2015. In the model, all figures are expressed on a comparable basis and the time series were transformed into logarithmic. This method makes it possible to present the link between performances within the same range.

As the main hypothesis is put forward that the amount of light industry depends on the level of productivity and production of cotton crops and investments.

To construct the mathematical model and to determine the forecast values used regression analysis - namely, multiple regression, which involves the construction of a model on the basis of several independent factors *X*, have an impact on the dependent variable *Y*.

Building a regression model consists of the following steps:

- selection factors;
- the definition of the link between the factors using correlation analysis;
- determination of the regression parameters and their significance;
- the adequacy of the regression model checking;
- plot assay;
- solution of regression and a forecast

Due to a clear interpretation of the parameters used linear function of multiple regression most widely in the economy, the equation of which is as follows:

$$\hat{y}_x = a + b_1 x_1 + b_2 x_2 + \ldots + b_m x_m \qquad (1)$$

where the parameters for *x* called the coefficients of the "pure" regression

The following indicators were used in the construction of the model - Light industry, mln. USD (*Y*); Gross production (services) output of agriculture mln. USD (*x1*); Gross cotton harvest, thous. tons of cotton (*x2*); Yields of major crops, quintals per hectare (*x3*); Investments in fixed assets cotton equipment and technology, mln. USD (*x4*); Inflation, % (*x5*); The price index of industrial producers, % (*x6*). The research period covers 25 years: 1991 – 2015 years.

In order to bring the proposed statistics to comparable figures were prodeflated (*DLOG*). In this case all the time series were converted to logarithmic. Such a process makes it possible to determine the relationship between measures within the same range. And before that, the initial indicators have different units.

An estimate of the production of the light industry of Kazakhstan has shown that this figure behave quite unstable over a selected period (Fig. 2). However, there is almost the

same trend - the growth of investment leading to an increase in output of light industry production.

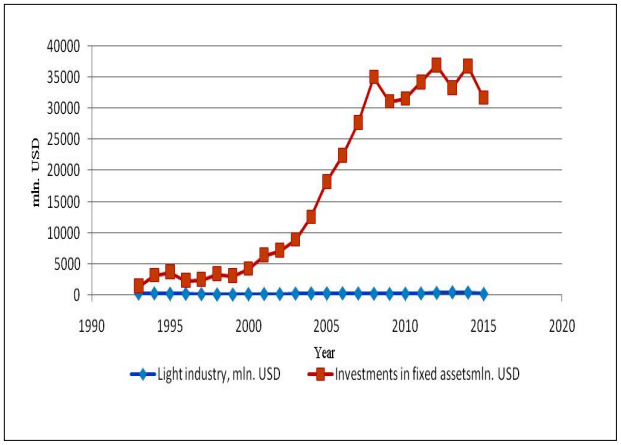


Fig. 2. The share of agriculture's contribution to the Gross Domestic Product of Kazakhstan

However, the last in 2015 with a significant increase in investment, there is a sharp drop in the output of light industry products - more than 16 times.

This is explained by the fact that the cost of cotton fiber in the domestic market is much lower than the price in foreign markets. Exports to non-CIS prevails in mind the stability and solvency of the market. Therefore, local businesses are much more profitable to sell cotton to foreign countries. Accordingly, the country is not cost-effective to engage in treatment and processing of cotton due to low prices and high cost of production of light industry goods.

Mathematical model is based on a statistical program package «Eviews 7.0». At the initial stage after the selection factors for the study eliminated multicollinearity factors by constructing a correlation table.

Correlation analysis is a method of determining a link between factors. The formula for calculating the correlation coefficient:

$$r_n = \frac{\sum_{i-0}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i-1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i-1}^{n}(y_i - \bar{y})^2}} \quad (2)$$

where r – the correlation coefficient; n – number of observations;

X_i – the value of a factor of production;

$\bar{X}$ – the average value of the factor X_i;

Y_i – the result value of production;

$\bar{Y}$ – the average value of the result of the production.

In constructing the correlation table has been revealed that among the factors X1 and Y, and Y and X3 exhibits a weak correlation, but this fact does not exclude the possibility of building the model. Between the independent factors X1 and X3 no multicollinearity, which suggests the possibility of constructing a two-factor model (Table 1).

Table I. The Correlation Matrix

Indi-cators	DLOG (Y)	DLOG (x1)	DLOG (x2)	DLOG (x3)	DLOG (x4)	DLOG (x5)	DLOG (x6)
DLOG (Y)	1						
DLOG (x1)	**0,649193303**	1					
DLOG (x2)	0,440594085	0,313005768	1				
DLOG (x3)	**0,674736656**	0,063124917	0,59135885	1			
DLOG (x4)	0,589183979	0,931819877	0,38424319	0,5919528	1		
DLOG (x5)	0,049447634	-0,42164808	-0,4457965	-0,3075827	-0,42854892	1	
DLOG (x6)	0,079684842	-0,22773766	-0,2459158	-0,155253	-0,23591704	0,67769277	1

In order to determine the statistical significance of each feature built regression statistics for all factors.

According to t-statistics can be determined that all of the factors X3 is statistically significant, as tb = 2.86186861 and> ttabl. = 2.57.

In the next step of research is built with the regression factor variable for estimating the regression parameters.

General regression equation quality control is carried out by calculating the coefficient of determination R^2, which is generally calculated as follows:

$$R^2 = 1 - \frac{\sum e_i^2}{\sum (y_i - \bar{y})^2} \quad (3)$$

.

The closer to unity the ratio, the greater the regression equation explains the behavior of y. The square of the correlation coefficient of $R^2 = 0,45$. This means - the variation factor explained 45% of the variation of resultant variable (Table 2).

Table II. Regression Analysis

Indicators	The regression statistics
Multiple R	0,674736655
R- square	0,455269554
Normalized R-square	0,429330009
Standard error	65,03178649
Observations	23

To assess the adequacy of the regression model is calculated t - Student test:

$$t = \sqrt{F} \quad . \quad (4)$$

where F – Fisher's F-ratio criterion.

The value of t calculated by the formula is compared to a critical value. If >, the recognized statistical significance of the regression model parameters.

Analysis of variance is: $Df = 1$ − number of degrees of freedom.

The parameters a = − 103,9337323, b = 16,42074488; SEM ma = 83,38706158 and mb = 3,91958174.

The model is adequate to F = 17,55, parameter $X1$ is statistically significant, as tb = 3,9> $ttabl.$ = 2.57

Interval estimates $yamin$ = − 277,3466194, $yamax$ = 69,4791548, $ybmin$ = 8,269528442, $ybmax$ = 24,5719613 for regression parameters with a confidence probability p = 95. The confidence intervals of regression parameters = -277,3466194 <a <69,4791548; 8,269528442 <b <24,5719613.

To test the hypothesis of no heteroscedasticity use White test [8].

When testing revealed that the probability of error of the first kind is equal to this value: 0.0000. That is less than the significance level of 0.05.

Hence, the null hypothesis of no heteroscedasticity is rejected. Thus, the resulting expression has the form:

$$Y = -103,9337323 + 16,42074488*X \quad (5)$$

On the basis of the obtained predictive equation shows that the increase in the yield of major crops and the flow of investment will lead to increased production in the light industry of Kazakhstan.

VI. RESEARCH RESULTS

On the basis of the study were identified such problems hindering the development of the system of agricultural products in Kazakhstan is reducing the acreage of crops, including cotton, melons, fruit and berry; an acute shortage of water resources; more than 70% of the raw materials exported abroad, so go easy processing plants; lack of competitiveness of production of local agricultural products; substantial import dependence on expensive imports of food products; there is a high degree of depreciation of equipment and the use of outdated technologies; there is a shortage of professional staff in the production of foodstuffs.

Constructed an econometric model has allowed to offer a series of recommendations for the effective operation of the processing areas of agriculture: the government take to curb the export of raw materials through the imposition of measures on the high duties on the export of products with a low degree of processing; the export of products with high added value must be encouraged through the provision of benefits; need to carry out modernization of agricultural enterprises, and improve the skills of technicians and engineers, agronomical specialties; the transition to international standards of quality agricultural products and expand the range of food products.

The practical significance of scientific work is determined by obtaining informed of the results and conclusions of the econometric modeling on the example of the production and processing of products of light industry in Kazakhstan. In this connection, it should strengthen the involvement of domestic and foreign investment in development of the processing food industry. It is assumed that, to a certain extent, they will promote the adoption of state and local authorities for effective solutions for the sustainable development of the processing of products of the agricultural sector of the republic.

REFERENCES

[1] P. Oosterveer, D.A. Sonnenfeld, “Food, Globalization and Sustainability, ” Routledge, 2011, 288 p.

[2] Ch. Dougherty, “Introduction to Econometrics. Oxford University Press, ” NY, 2011, 512 p.

[3] J.R. Maxwell, M. Gittinger, “Textiles of Southeast Asia: Tradition, Trade and Transformation,” United States, 20 August 2014, 432 p.

[4] G. Myrdal, “The political element in the development of economic theory. Transaction Publishers, ” Psychology Press, 1998, 248 p.

[5] Sh. Smagulova, N. Radko, “Analysis of the Oil Market and the Role of Investment in the Agrarian Sector in Kazakhstan, ” International Journal of Economics and Financial Issues, Turkey, 2016, 6(2). – pp. 798-806. ISSN: 2146-4138, available at http: www.econjournals.com.

[6] E. Patrick, McNellis, “Foreign investment in developing country agriculture – the emerging role of private sector finance, ” FAO commodity and trade policy research working paper, № 28, 2009, pp.28–45.

[7] D.V. Serdobintsev, O.V. Matveeva, L.V. Sorokina, “World European and Russian experience of development of a clustering policy in agro-industrial complex, ” Fundamental research, №9, 2014, pp.1825–1839.

[8] H. White, “A Heteroscedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroscedasticity,” Econometrica, Vol. 48 No. 4, 1980, pp. 817–838.