The Solution of Economic Tasks in Agricultural Sector by Methods of Mathematical Modeling

(by the example of East Kazakhstan Area)

Kurmangalieva Nurgul

KazFEA the Republic of Kazakhstan, Semey city, Republic of Kazakhstan
nurgulkk62@mail.ru

Abstract

This article describes a study of socio-economic processes. In the new economic conditions and rising flows of scientific and technical and economic information, more and more sense of urgency to solve economic problems by methods of mathematical modeling and forecasting. We are doing an analysis of livestock production of the East Kazakhstan region on the basis of agroformations.

Keywords: Agro-industrial complex, animal husbandry, mathematical model, economical and statistical analysis, linear model, multiple regression

Nowadays mathematical methods of the analysis and forecasting become the important implement in planning, analytical, marketing departments activity of the industrial enterprises. The improvement of population supply of the Republic of Kazakhstan by agricultural products in many respects is defined by the rational use of regional resources of raw material for their manufacture basing at their complex processing.

The development of agricultural sector was stabilized for the last years in the East Kazakhstan area. Positive changes are observed in increasing of agricultural production manufacture and products of its processing in the regions of East Kazakhstan area. The level of foodstuffs import is reduced, the equipment by the agricultural machinery and device grows.
The acceptance of certain measures on stabilization of AIC branches promoted the further agricultural manufacture development increased its efficiency and food supply security provision of the area.

On support of agricultural sector in 2010 more than 8,3 billion tenge was given and mastered from all sources, including more than 1,4 billion tenge of direct transfers were done and also mastered from the Republican budget. Also 92,5 million tenge was given and mastered from the regional budget.

Due to state support measures gross production volumes of an agricultural sector in 2010 were more than 69,2 billion tenge.

The cattle breeding of the area is one of the basic branches of agrarian sector, and the standard of well-being of the village population, self-sufficiency of region by the products of a feed first of all with meat and milk depends on its condition and development in many respects.

On the results of job for 2010 all indexes in the area exceed the indexes of 2009: on number of cattle (on kinds) on average on 3 %, on manufacture: meats - on 4 %, milk - on 2 %, eggs - on 4 %, wool on - 4 %.

Kindle (on kinds of cattle) was on 2-3 % more in comparison with 2009, and the loss of cattle has decreased on animal kinds from 1 up to 36 % [1].

With the purposes of livestock breeding development and the expansions of trade partnership between farm manufacturers of the area the exhibitions - auctions of breeding cattle are spent annually.

Population is arranged on opening the points of an artificial insemination of the cows for the perfection of breeding job with low productive and outbred cattle.

The semen of the best domestic high-productive dairy and dual-purpose breed of the great cattle is delivered to these points to get the herd with higher potential of the efficiency.

To the basic competitive advantages of area concerned: a favorable geographical arrangement, presence of rich pastures, surplus of the population of able-bodied age, presence of an industrial infrastructure allowing successfully to realize an export potential of great cattle meat in regions of the area.

The research of socio economic processes is the revealing of the basic tendencies of development, studying of influence of market economy with methods of state regulation, which require applications of a wide spectrum of scientific methods. Including methods of mathematical modeling and modern information technology.

The process of modeling includes three structural elements:
- The object of research;
- The subject (researcher);
- Model, which shows the relation between the cognizer and cognized subject.

In the new conditions of managing both growth of the scientific, technical and economic information flows the actuality of economic tasks solution by the methods of mathematical modeling and forecasting grows more and more. The
successful use of mathematical methods in practice is possible only in combination of knowledge in the field of methods with deep knowledge of research object, with the substantial economic analysis of the investigated fact.

Nowadays it is possible to use mathematical models in the agricultural sector because of wide computer engineering implementation.

The mathematization enables to raise the quality of the accepted solutions at all stages of process of solution acceptance by the man or by the computer by means of application of modern multiple factor analysis methods, forecasting, modeling and estimation of variants, optimum planning. It allows proceed to scientifically proved approaches development to the acceptance of the optimum decision in a concrete situation during the tasks solution of various subject domains.

The solution of economic-mathematical tasks in agricultural sector enables not only to analyze an initial condition of considered system, but also to predict its socio economic aspects of development in prospect. [2]

The basic task of econometric research is revealing of influence of all kinds of agro-formations on agricultural GDP in the East Kazakhstan area. The statistical data for 2006 – 2010 (Table 1) and following 3 equal factors (Xj) [3] were taken for the solution of this task:

\[ x_1 - \text{Agricultural enterprises, million tenge.} \]

\[ x_2 - \text{Peasant farm enterprise, million tenge.} \]

\[ x_3 - \text{Private farm holdings on all types of production, million tenge.} \]

The given factors have the certain independence from each other and close link at the same time with a productive parameter \( G \), which is a parameter describing a long-term influence of the factors set, i.e. it is required to construct multiple linear regress.

The main purpose of multiple regress is to construct model with the large number of the factors having defined a degree of influence of each one and in aggregate on a simulated parameter. The linear model for multiple regress looks like:

\[ G = a_0 + a_1 x_1 + a_2 x_2 + a_3 x_3 \]

\( a_0 - \text{Constant term} \)

\( a_1, a_2, a_3 - \text{Regression coefficients} \)
Table 1 – Cattle basic production on all nature of household in East Kazakhstan region for 2006-2010

<table>
<thead>
<tr>
<th>Years</th>
<th>Meat (deadweight) thousand tons</th>
<th>Milk thousand tons</th>
<th>Wool (gross weight) tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>In agricultural enterprises</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>17,78</td>
<td>19,02</td>
<td>19,0</td>
</tr>
<tr>
<td>In peasant farm enterprise</td>
<td>16,08</td>
<td>17,2</td>
<td>19,4</td>
</tr>
<tr>
<td>In private farm holdings</td>
<td>66,03</td>
<td>70,6</td>
<td>72,3</td>
</tr>
</tbody>
</table>

All calculations were made in the EXCEL tabular processor and the following models are received:

\[ G_1 = 4623,4x_1 + 6223,5x_2 - 132,4x_3 \text{ – meat gross output;} \]
\[ G_2 = 5423,4x_1 + 1403,2x_2 - 523,4x_3 \text{ – milk gross output;} \]
\[ G_3 = 83,44x_1 - 4,1x_2 - 10,4x_3 \text{ – wool gross output} \]

The given calculations for agro-formation allow make the following conclusions:

1. It is profitable for agricultural enterprises to make all kinds of production, but the milk release is more efficient because on 1 million tenge of the enclosed expenses the profit is 5423,4 tenge and meat manufacture is on 4623,4 tenge;

2. Peasant farm enterprise should consider, that gross tax of wool has inversely proportional character to their profit, so to concentrate on these kinds of production is not recommended, because they are unprofitable;
3. The private farm holdings have profit 1 million tenge on milk manufacture of the enclosed expenses on 523, 4 tenge, and under the gross tax of wool is 10, 4 tenge. And it is recommended to produce the other kinds of production for personal consumption only.

Thus, the results generalization of the economic-statistic analysis of agricultural manufacture of the East Kazakhstan area allows receive the information for strategic and short-term planning of agricultural manufacture activity.

The project model is interesting to those experts who are engaged in a problem of information system creation with mathematical model of the processing enterprises.

References


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