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The model of regional agroindustrial development

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Abstract

The economic–mathematical model of development of the agroindustrial complex (AIC) is proposed. It allows to optimize the structure of branches of AIC, to distribute the limited resources among the branches taking into consideration the power expenses and the solvent demand of inhabitants

The existing methods of estimation of different products by the cost indexes don't allow to receive full presentation about the economic effectiveness of their output. The cause of this situation is the variation of the prices, that became sharp and intensive especially in the period of transition to market relations. The prices of the foodstuffs were subjected to the most changes lately. In 1992 in comparison with 1991 their level was increased almost by 34 times, but in 1995-1990 the annual price index didn't exceed 5 per cent. The analysis of the cost indicators is not enough for determination of the efficiency of the agroindustrial production, because the rise in prices and change of their structure are unforeseen. The cost analysis must be supplemented by the power estimate, based on more stable indexes of the power capacity of the production.

The necessity to conduct the power analysis of the agroindustrial production is caused by the intensive rise of consumption of the power resources in agriculture when every unit of the product rise demands the fossil power much more. Lack of the own fuel power resources and rapid rise in prices make worse the complicated state of the economy of Republic Moldova. A problem of reduction of the expenses of power resources became especially pressing today.

Several works [1-5] were dedicated to solving of questions of the register and the analysis of the power capacity of the production. The proposed methods of analysis of the power consumption are applied to private sorts of the cultures or separate technology of the production. The different methodological and information bases of calculation hamper generalization of results and their application. Besides that all investigations are referred as a rule to the agricultural production. While a big part of the aggregate power, spent on the final production, falls on the branches of industry, production and social service. Because power inputs must be investigated in all spheres and branches to uncover shortcoming of the organization of agroindustrial complex (AIC) and to define the ways of further development.

The proposed mathematical model of the regional AIC serves as a base for solving of this problem. It allows to link the demand of inhabitants for foodstuffs and their export with resources for output of these products, to optimize structure of branches of the complex, to distribute the limited resources among the branches taking into consideration the power inputs.

The designations for description of the model of the AIC are:

i - index of items of the agricultural production ($i \in I$);

I - set of indexes of items of the agricultural production ($I = I_1 \bigcup I_2 \bigcup I_3 \bigcup I_4$);

I_1 - subset of indexes of items of the vegetables ($I_1 \in I$);

I_2 - subset of indexes of items of the perennial plantation ($I_2 \in I$);

I_3 - subset of indexes of items of the stock-raising production ($I_3 \in I$);

I_4 - subset of indexes of items of the bread grains, technical and fodder crops ($I_4 \in I$);

j - index of items of the industrial production ($j \in J$);

J - set of indexes of items of the industrial production;

t - index of directions of utilization of the agricultural production ($t \in T$);

T - set of indexes of directions of utilization of the agricultural production ($T = T_1 \bigcup T_2$);

T_1 - subset of indexes of directions of utilization of the agricultural production for the local market ($T_1 \in T$);

T_2 - subset of indexes of directions of utilization of the agricultural production for the export ($T_2 \in T$);

T_3 - subset of indexes of directions of utilizations of the agricultural production for the industrial production ($T_3 \in T$);

n - index of items of technical and biological resources ($n = 1, 2, \ldots, N$);

f_i - crop yields or productivity of one head of the animal;

A - land under crop;

P_i - area to the i perennial plantations or numbers of the basic head of the animal giving the i production;

a_{ij} - rate of inputs of i agricultural production for output of unit of j industrial products;

Q_i - demand of inhabitants for i products;

Q_j - demand of inhabitants for j food products;

C_i - volume of export of the i agricultural products;

C_j - volume of export of the j industrial products;

b_{ni} - expenses of the n resource for output of unit of the i agricultural products;

b_{nj} - expenses of the n resource for output of unit of the j industrial products;

H_n - quantity of the n resource at the beginning of the forecasting period;

α_{it} - retail price of unit of the i farm produce starting on the t direction of utilization;

α_j, α_j^* - retail price of unit of the j industrial production for the local market and export;

φ_{it} - expenses on the production and realization of unit of the i production starting on t direction of utilization;

φ_j, φ_j^* - expenses on the production and realization of unit of the j industrial products for the local market and export;

k_i - rate of specific capital investments on 1 hectare of perennial plantations or on building of the animal farms at a rate per the head of animal giving i animal products;

k_n - cost of unit of the n resources;

g_i - power capacity of unit of the i farm products;

g_j, g_j^* - power capacity of unit of the j industrial products for the local market and export;

$g_i^\diamond$ - bioenergy content of the agricultural land in 1 hectare or 1 head of the animal for the production of the i agricultural products;

g_n - power capacity of unit of the n resource;

x_i - land under i crop in forecasting period ($i \in I \setminus I_3$);

X_{it} - volume of output of the i agricultural production for the t direction of utilization ($\sum_{t \in T} X_{it} = X_i$);

χ_j, χ_j^* - volume of the output of the j industrial products for the local market and export;

Y_i - increase of the land under perennial plantations or increase of the basic head of the animals giving the i agricultural products in the forecasting period;

Y_n - increase of the n resource in the forecasting period.

Conditions of the problem:

1. Balance of production and consumption of the agricultural products:

$$X_i - f_i x_i = 0, \qquad i \in I_1 \bigcup I_4,$$

$$X_i - f_i Y_i = f_i P_i, \qquad i \in I_2 \bigcup I_3.$$

2. Conditions of utilization of the agricultural raw materials for the processing industry:

$$\sum_{j \in J} a_{ij}(\chi_j + \chi_j^*) - \sum_{t \in T} X_{it} = 0, \qquad i \in I.$$

3. Conditions of satisfaction of the solvent demand of inhabitants for foodstuffs:

$$\sum_{t \in T_1 \setminus T_2} X_{it} \geq Q_i, \qquad i \in I \setminus I_4,$$

$$\chi_j \geq Q_j, \qquad j \in J.$$

4. Conditions of export of the agroindustrial products:

$$\sum_{t \in T_2 \setminus T_3} X_{it} \geq C_i, \qquad i \in I,$$

$$\chi_j^* \geq C_j, \qquad j \in J.$$

5. Conditions of utilization of the technical and biological resources for the production of agroindustrial products:

$$\sum_{i\in I} b_{ni}X_i + \sum_{j\in J} b_{nj}(\chi_j + \chi_j^*) \le H_n$$

(for hard limited resources) or

$$\sum_{i\in I} b_{ni}X_i + \sum_{j\in J} b_{nj}(\chi_j + \chi_j^*) - Y_n \le H_n$$

(for less limited resources).

6. Non negativeness of variables.

At present the multiversion statement of a problem is expedient. It allows to use several criteria and different values of the limiting conditions.

Maximum profit from the sale of the final products is used more often as a criterion of optimization:

$$F = \sum_{i\in I\setminus I_4}\sum_{t\in T\setminus T_3}(\alpha_{it} - \varphi_{it})X_{it} + \sum_{j\in J}(\alpha_j - \varphi_j)\chi_j$$

$$+\sum_{j\in J}(\alpha_j^* - \varphi_j^*)\chi_j^* - E(\sum_{n}^{N} k_nY_n + \sum_{i\in I_2\bigcup I_3} k_iY_i).$$

The estimate of the effectiveness of the agroindustrial production with the help of this criterion is correct and necessary in the market conditions.

The statement of problem, based on application of the criterion of minimum expenses, is correct in the presence of information about the volume and structure of the demands of inhabitants for foodstuffs,about the export.

$$F^* = \sum_{i\in I\setminus I_4}\sum_{t\in T\setminus T_3}\varphi_{it}X_{it} + \sum_{j\in J}\varphi_j\chi_j + \sum_{j\in J}\varphi_j^*\chi_j^* + \sum_{i\in I_2\bigcup I_3} k_iY_i + \sum_{n}^{N} k_nY_n.$$

But the cost indexes don't always show the true state of economic system, because the prices are fluctuating very sharply. Liberation of the prices makes the problem of definition of effectiveness of development of the regional AIC still more complicated in the time of instability of the market. It is necessary to conduct the multiversion calculation taking into account the different levels of the prices at this situation.

The index of the expenses calculated in power equivalents must be considered parallel with the cost parameters. Criterion of optimization, created on the power indexes, assumes to solve the problem on minimum of the power expenses:

$$F^{\diamond} = \sum_{i \in I} g_i X_i + \sum_{j \in J} g_j \chi_j + \sum_{j \in J} g_j^* \chi_j^* + \sum_{i \in I_2 \bigcup I_3} g_i^{\diamond} Y_i + \sum_{n}^{N} g_n Y_n.$$

The using of this criterion allows to optimize development of the AIC taking into consideration economy of power resources. Besides that prices have no influence on it.

The stage of preparation of information for carrying out calculations on worked out models of regional AIC is more difficult. This is connected with lack of the necessary parameters in statistic forms. The indexes are presented itself as a rule in enlarge range of the products and resources. It is inadmissible for studying of the power inputs. The difference in power capacity of the diverse products exceeds far the difference in stuff capacity. Because any small changes of the inter group structure give the considerable changes of the value of the total power inputs. It doesn't allow to define the dynamics of actual power consumption and to give the objective estimate of its efficiency. The additional calculations must be conducted for receiving of the necessary data.

It is impossible to calculate the necessary index by the only method, because many account forms and lack of correspondence between data don't allow to do it. For example, it is necessary to look through 7 sources of the statistic data and to use 8 methods of its processing to define the volume of the output of the 57 items of the agroindustrial products. The analogous situation is seen when the calculations

of the quantity of the industrial processing of some items of the farm products or the value of resources going to output of the agroindustrial production take place. This situation hampers considerably the calculations of the incoming indexes of the models and demands to create urgently the data base and to mechanize their working. However the intensive changes of the statistic registration make the solution of this problem very difficult. At present it is necessary to use statistic forms, in which the information is presented partially processed. The data of the natural-cost balance of production and distribution of the agroindustrial products is the base for informational guaranty of the model of development of AIC. These are quantities of the output of agroindustrial products, the values of its industry processing in the different branches, the values of some resources (head and electrical energy, the amortization of the basic production funds, labour inputs). The resources that as the fertilizers, weed- killers and pest-killers, agricultural equipment, petrol and diesel oil, production buildings and constructions, transportation, glass and tin packing are calculating by the proposed methods on the basis of the information taking out from other sources.

Determination of the solvent demand of inhabitants for food- stuffs is the most difficult, but very important problem of optimization of the power consumption in the AUC in the time of instability of the market.

The analysis of development of the demands for foodstuffs allows to expose more considerable factors having an influence on them. They are: total volume of solvent demands, money incomes per head of inhabitants, retail prices, entering provision from sources not connected with market.

Releasing of prices and unforeseen policy in sphere of incomes of inhabitants don't allow to define synonymously their levels in prospect. It is expedient to consider some values of the factor indexes. They will be a base for the conducting of multiversion calculations of the demands.

Using of the different criteria, natural, cost and power indexes exposes new possibilities for studying of dynamics of level and correlation of prices, for determination ways of economy of resources.

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