ЕКОНОМІКА ТА УПРАВЛІННЯ ПІДПРИЄМСТВАМИ (ЗА ВИДАМИ ЕКОНОМІЧНОЇ ДІЯЛЬНОСТІ)

Kukina Natalia,
Associate professor of the economic theory department,
Popova Tetiana,
Associate professor of the economic theory department,
Tavria State Agrotechnological University

JUSTIFICATION OF THE OPTIMAL PARAMETERS OF LAND USE IN AGRICULTURAL ENTERPRISES

Summary. *The paper is focused on the investigation of scientific and methodological bases of agricultural business. The game theory is used for justification of rational sizes of enterprises.*
Key words*: enterprise, land use, development, efficiency, agriculture.*

Introduction. The development of agribusiness is a reality of our time, a result of the transformation of the agricultural sector. Agricultural entrepreneurship should remain a dominant sector of the economy in long-term perspectives. Therefore, the rational organization of agricultural enterprises should provide optimal concentration of production in order to maximize efficiency by restraining the process of land area size reduction.

We know that enterprises based on land renting have all the necessary potential for increasing their farms. However, their strategy should be oriented not only on maximum, but on the optimal size of farm lands, including qualitative and quantitative assessments of the process.

Many national economists have aimed their researches at the investigation of agricultural enterprise development. Among them are P. Haidutsky, M. Koretsky, Y. Kovalenko, P. Makarenko, M. Malik, L. Melnyk, V. Messel-Veselyak, O. Onishchenko, P. Sabluk, V.Yurchishin. They have combined theoretical and practical research studies in the area of formation and development of Ukrainian business. In addition they have highlighted issues related to optimization of the economic basis of an enterprise size. However, many scientific justifications have to be explored.

The main goal of the research is determining the optimal size of farm land in the Zaporozhye region using the game theory modeling.

Materials and methods. The main objective of the qualitative assessment is to determine the whole range of possible competitive advantages attributed to the optimal level of the production concentration. However, reasonable adjustments of the land use size, it is necessary to provide quantitative estimate of land use. This process requires special scientific methods. Scientific research related to farm size optimization includes the process of hypothesizing, forecasting perspectives of the development, and then explaining the results.

To determine the optimal size of the enterprise, it is considered a multipurpose system, based upon some fixed sets of possible conditions. During the system optimization each variation of the system is being evaluated.

Actually, conditions of the functioning of enterprises have accidental nature. This fact is an important during the selection of the rational farm size. That is why it is recommended to consider a set of conditions, which ensures the greatest minimum value of the criterion (pessimistic approach) or maximum of the greatest maximum value of the criterion (optimistic approach).

Both approaches are based on the concept of applying the game theory modeling, which refers to the theory of mathematical models and methods related to optimal decision making under uncertain conditions. A static model generated by the game theory is a widely accepted model for decision making under uncertainty.

The subject of the theory of making optimal decisions under uncertainty and risk caused by it is to study rules of apriori and aposteriori conversion of information about the state of the object and economic system in the quantitative component of the information management.

Experiment results and discussion. When using the static model of decision making where uncertain conditions and related risk, it is advisable to use a scheme, which includes the existence of:

1) an identified economic environment for which it is defined a set of mutually exclusive and mutually reinforcing conditions;

2) a set of mutually exclusive decisions;

3) a functional evaluation characterizing "gains" or "losses" in selecting the optimal solution.

The approach when we choose the greatest minimum values of criterion from the set of conditions is considered a pessimistic approach because it leads to guaranteed (risk-free) implications for the optimal decision. The optimistic approach is applied for modeling the environment dynamics, which is considered the most appropriate balanced combination of the best and worst. This approach to the selection of optimal solutions, known as an indicator of pessimism-optimism, which provides only partial antagonism of environment.

Based on profitability changes, due to the possibilities of land use options, we calculated different options of profit indicator such as the amount of profit per each hectar of agricultural land. The results are presented in a Table. 1, where the best size settings of land in the Zaporozhye region are determined.

Table 1

Parameters of farm land in the Zaporozhye region under the conditions of profitability variations of the primary production (2010 to 2014)*

Group of farms	Land use size of farms, ha	Amount of profit per 1 hectare of agricultural lands depending on the profitability of primary production, UAH / kg				ai = min gij	Sопт	βi = max gij
		from 0%	from 0,1 to 20%	from 21 to 40%	from 41% and above			
1	від 0 до 3000	-161,89	83,83	222,73	610,29	-161,89	-	610,29
2	від 3000 до 6000	-43,79	108,07	466,46	609,19	-43,79	-43,79	609,19
3	від 6000 до 9000	-122,9	91,31	330,21	688,3	-122,9	-	688,3
4	від 9000 і вище	-105,07	146,36	332,52	733,72	-105,07	-	733,72

*Source: Calculated according to the Form 50 of agricultural enterprises of Zaporozhye region [5; 6; 13]

The optimization process starts from the Maximin position, which means that it is elected a group of enterprises, having such land sizes, which guarantee them the largest (maximum) of all the worst (minimum) possible outcome of actions for each group (Table. 1):

$$ai = \min gij \quad (1)$$

According to this, the best land use options correspond to the second group of farms. Their land size options range from 3,000 to 6,000 hectares of agricultural land:

Sopt = max (-161,89; -43,79; -122,9; -105,07) = -82,76 UAH./Kg.

In any economic environment the result is not worse than 82.76 UAN./quintal. This

amount of profit per unit of land is a guaranteed result for most agricultural enterprises, and can be considered as the lowest efficiency limit.

A similar process for other environments, ratios of profitability and sizes of land use is applied to identify the worst guaranteed (minimum) outcome (the profit per each hectare) of all the best (maximum) outcomes of actions for each group of farms. The solution that maximizes profit for each option of profitability and for each group of land is chosen using the formula:

$$\beta i = \min (\max gij) \quad (2)$$

According to this optimal parameters of land use also correspond to the second group of the region at farms:

βi = min (610,29; 609,19; 688,3; 733,72) = 609,19 UAN./quintal.

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Under the conditions of the least best outcome of all actions from all best outcome for each group of land size, farms would get a profit, the amount of which will not exceed the minimum 609.19 UAN./quintal. This profit is the upper limit of efficiency of agricultural enterprises.

To confirm the selected optimal solution for the pessimistic assessment, the optimization position will also be used. Its limit is regulated by indicators of pessimism and optimism. Accordingly, each solution is determined by a linear combination of the maximum and minimum prises:

$$Sopt = x \min gij + (1- x) \max gij \quad (3)$$

where x - the probability of a worse result;
(1 - x) - probability of a best result.

The three versions of the economic environment will be analyzed following pessimistic assessment (x = 0.8), an equivalent valuation (x = 0.5) and an optimistic assessment (x = 0.2). The optimal solution for each alternative of economic environment is land-use options in which the value of the index of profit will be the greatest (max Sopt = S). The calculation results for each group of land size holdings in the region are summarized in Table. 2.

Consequently, the use of multi-system, based on the game theory, established that goal of improvement of the productivity is most achieved by those farms that have preserved the integrity of the land at nine and above thousands of hectares of agricultural land and did not follow the route of unjustified decreasing reformed enterprises.

Table 2

The indicator of profit per unit of land for each group size of land holdings in Zaporozhye region*

Group size	Farms land area, ha	Amount of profit per 1 hectare of agricultural land depending on options of probability of worst outcome UAH./ Kg		
		X = 0,8	X = 0,5	X = 0,2
1	from 0 to 3000	-7,454	224,2	155,854
2	from 3000 to 6000	86,806	282,70	478,594
3	from 6000 to 9000	39,34	282,70	526,06
4	from 9000 and above	62,69	314,325	565,962
Sопт = max Sj		86,806	314,325	565,962

*Source: Calculated by the author

In general, only these farms were able to use skillfully and successfully market and economic potential, which is an important impetus for the effective development in the conditions of the optimistic economic environment.

However, the pessimistic scenario based on the criteria probability, profitability and risk is applicable to the enterprises with land size options ranging from 3,000 to 6,000 hectares of farmland. This size enables industrial, economic, organizational, administrative functioning and allows these farms to achieve relatively good and effective development even in the uncertain and unpredictable economic environment.

Conclusions. Numerous approaches lead to the conclusion that the optimal land size is the key to social and economic development of land use enterprises. The lower limit for optimal efficiency is at least 3,000 hectares of contiguous farm lands.

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