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PROSPECTS OF AGRARIAN FORMATIONS DEVELOPMENT AT THE STAGE OF LAND RELATIONS TRANSFORMATIONS IN UKRAINE

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Abstract

The article provides insight into improvement of the methodological approaches and methodic tools concerning solution of polyvariant tasks of land management with application of mathematical programming. Variety of the forms of initial information description forces both choice of the methodology of research concerning land use, and the model form. It is proven that appropriate application of mathematical programming secures the most rational use of land resources, which are one of the most important constituents of the system of land relations regulation. Territory of Ukraine is chosen as an object of the research, because the research studies transformation of land relations in the process of land reform implementation. The article presents results of empiric analysis, which argues the necessity to perform land surveying, which makes a base for an accurate land circulation and develops scientific approaches to formation of the structure of land use and administrative-territorial organization, protection of lands, as well as their ecosystem functions, supply of the branches of land resources economy, etc. The empiric investigation confirms and theoretically grounds that at the final stage of the land reform in Ukraine it is necessary to develop an appropriate scientific-theoretical basis, which would contribute to establishment of the system of modern flexible and efficient agrarian formations, being able to reveal the whole potential of Ukrainian black land soils.

Key words: *agrarian formations, market relations, land reform, mathematic modeling*

INTRODUCTION

Implementation of the land reform in Ukraine demonstrates both positive and negative consequences. In numerous cases, organization of agricultural land use is performed only from the position of maximum profit, without regards to its ecological component and neglecting land organization. According to the Law of Ukraine "About Land Organization", land organization is a complex of social-economic and ecological measures, aimed to regulate land relations and rational organization of the territory of administrative-territorial units and business entities. The measures are performed under the impact of social-productive relations and development of productive forces [10].

MATERIALS AND METHODS

Researches concerning agricultural land use by agrarian formations and agrarian holdings in Ukraine under current conditions are performed by V. Bilyk [1], S. Volkov [19], V. Holian [4], T. Zinchenko [20], V. Kurochkin [5], A. Martyn [6], N. Palianychko [7], S. Pyrozhkov [8], V. Snitynskyi [13], M. Stupen [17], R. Trynko [18], A. Shvorak [11] and others. Works of the scientists have developed a system approach and practical recommendations concerning improvement of the organization of rational land use, particularly agricultural lands.

The article proposes another direction of the mentioned problem solution, i.e. by development of the projects of land organization concerning organization of a scientific approach to land use.

The main task of the article is to ground the necessity to develop the projects of land organization for agrarian formations and agrarian holdings of Ukraine in order to

improve the system of land management and ecology of land resources.

Special attention is also paid to improvement of the methodological approaches and methodic tools concerning solution of polyvariant tasks of land management with application of mathematical programming.

RESULTS AND DISCUSSIONS

Nowadays, we reap the benefits of errors in implementation of the land reform in Ukraine. Currently, there is a process of formation of agrarian enterprises, founded on the base of hundreds of land shares. However, practically, the process is not always successful and the formations do not meet the world standards.

As of January 1, 2017, in Ukraine there were 1,1 million hectare of degraded, low-productive and technologically polluted lands, which had to be conserved, 143.4 thousand hectare of deteriorated lands, which required reclamation, and 315.6 thousand hectare of low-productive lands, requiring improvement [6].

Considering the fact that currently the main task of agrarian producers is to get a maximum profit, while neglecting ecological and social indicators, one should note that quality of economic activity is not the indicator of rational use of land resources.

However, the situation with development and introduction of the projects concerning land organization with optimization of the schemes of territory organization has principally changed. Currently, private landowners should choose the most desired projects by themselves, and local communities should agree to the corresponding changes of the schemes of their territory organization. Nowadays, land management service should propose some the most suitable models of land organization to land owners concerning their territories as well as some scenarios of their introduction. Only after agreement of the scenarios with local population, they should move to development of a final project of land organization and business-plans for new farms. It should be agreed with almost every resident of the territory and with each juridical person. Thus, it is really necessary to organize special public land committees in each settlement to visit everyone.

Organizational fundamentals of land fund protection should be crucially transformed. Particularly, protection of the lands, used for growing of agricultural products, should be a compulsory constituent of technological processes of arable farming, and the process should be controlled by the Ministry of Agrarian Policy and Food of Ukraine [4, p.28].

Efficiency of land organization of particularly valuable lands is first represented by the opportunity to define lands of different quality by means of classification and zoning. Thus, low-productive lands can be withdrawn of non-agricultural use, high-productive ones can stay in agricultural circulation. However, withdrawing low-productive lands and substituting the gap with developed lands without their rational use, we get a rise of yield capacity by improvement of soil fertility, increase of income of agricultural enterprises [2, 8, 11, 13, 20].

Formation of the directions of land use processes regulation should be initiated at a local level. However, the basis is made by establishment and development of the institute of land management. The institute of land management is considered as a complex of permanent formal and informal rules, norms, procedures of all participants of land management processes, i.e. local authorities, state administration, juridical and physical persons, etc. [3, 7, 9, 10].

Under conditions of legal uncertainty, investors become actual owners of land. They got money from oil-gas and other kinds of business and are called oligarchs. Consequently, land gradually becomes to be owned by those, who have never treat it and will never do, while a peasant, who has been a farm-hand, will stay in the same position [1, p.10].

It is obvious that Ukrainian farmers are not able to overcome all bureaucratic obstacles by themselves and export their products. It makes them less competitive comparing to the large agrarian formations and agrarian holdings, which apply modern machinery and technology, have access to cheap credits, tax

privileges and thus, get profits that are much higher than the average at the market.

It is worth mentioning that excess of the profits of agrarian formations and agrarian holdings over the average level in agrarian sector is connected with the moratorium and relative arrears of the prices for land comparing to their potential. Some scientists argue that appearance and development of agrarian holdings in Ukraine and other former republics of the USSR is an understandable consequence of inefficient implementation of land reform, particularly land one [17, p.92].

If the state does not increase investments into reproduction of natural-resource potential and does not stimulate the business sector to behave in the same way, the resource base of many branches of the national economy will be intensively reduced. Consequently, it will cause a considerable fall of the level of economic self-capability of our country and will bring it into the category of outsider-countries in the global economic environment [5].

The bodies of executive branch do not propose to perform consolidation of lands for improvement of land relations and there is no any law about land consolidation in the country, as well as no projects of land organization concerning land consolidation.

Consolidation of lands was a constituent of land reform in almost all countries of Europe. Owners rejected their land parcels within the territory of the developed project of consolidation and got new land parcels of the corresponding value [18, p.13; 15, p.67].

Consolidation of agricultural lands includes a complex of juridical, social-economic and ecological measures, focused on optimization of sizes and location of land parcels for organization of rational and the most efficient land use in the interests of an owner or a land user, and the society in general.

In the context, one should note that development of land use depends on an appropriate and efficient use of land, as well as on labor forces, fertilizers, agricultural machinery, transportation means and other resources. The experience proves that skillful application of mathematical programming helps the most complete and rational use of the resources [14, 16].

Modern theory of land use management is based on the concept of optimization. Thus, it is necessary to find optimal solutions, i.e. value of variables, which secure a maximum (minimum) for the objective function and satisfy a set of constraints. Speaking about objectives and constraints, it is mostly assumed they are well-known. Recently, it has become a clear idea that the theory of production management has reached the edge when uncertainty is of great importance.

Capability to solve the uncertainty [12] or simply work with it requires careful attitude to the environment. It forces the necessity to consider the made decisions, where objectives and constraints are not clearly defined. It is important to learn how to identify such type of tasks, characterize peculiarities of their solution and develop methods of their solution, as far as it is possible.

Under conditions of uncertainty, making of decisions in the system of land use should be interpreted as a conflict of the subject, who makes the decision, and the "nature". Thus, it is considered as a game [19].

Tasks of decision making under uncertainty conditions are characterized by the fact that each definite choice gives the only value of the objective function. It means that there are no particular difficulties about advantages description at outcomes. Thus, each person, making decision, works with a number of accurately determined objectives, which make base for determination of the necessary advantages.

Considering definite actual situations of decision-making, one should note that they do not meet requirements of the described scheme.

It is obvious that actually decision-making applies the expression of the type "Z should be in close surrounding of Z*", which is not a clearly defined objective.

It is known [14; 16; 12] that some fuzzy conditions can be considered as a number of X alternatives along with its fuzzy subsets, which are revealed in unclearly defined criteria (objectives and constraints).

Practically, it often deals with application of an accurate theory of optimization of fuzzy

models, where there is no reasons to write accurate figures and there are often difficulties, being hard to overcome.

Science and practice prove that character of the employed information defines application of determined, statistical, inaccurate and calculating methods. Such rubricating helps choosing of a group of methods, as well as methodology of the research at the initial stage of land use optimization (in the process of collecting and estimating of informative base of the research). In case of inaccurate methods, they use different statements: flexible planning, fuzzy mathematical programming with clear objectives, linear programming with fuzzy coefficients, robust programming, tasks of achievement of inaccurately set goals with clear constraints, aggregate task of fuzzy mathematical programming.

Let us consider some aspects of flexible planning, particularly planning of land use. The aspects are expressed in the form of tasks of linear programming. They are characterized with constraints of the following expression:

$$\sum_{j=1}^{n} a_{ij} u_j \le b_i, \quad i = \overline{1,m}, \qquad (1)$$

which determine an admissible domain.

It is clear that in case of incompatible constraints the domain is empty. Thus, it is desired to make modification of the constraints. Subject of planning should get to know how it is possible to change constraints of the task to find available solutions. Actually, the subject wants to know how minimally change the initial variant of the description, in order the task can be solved. It is obvious that is requires changes of bi coefficient. However, how much should it be changed?

The authors of the article consider that planning is made in a flexible way, i.e. the planner operates not with figures, but with intervals. It means that in spite of bi figures, the planner uses the intervals [bi, Bi]. Thus, the previous task can be successfully solved, in case the interval includes such figure

$$\sum_{j=1}^{n} a_{ij} u_j \le \gamma$$

γ, that inequality describes an admissible domain.

Now, let us describe the procedure of detection of the figure γ in the interval [bi, Bi]. The figure is close to bi, or, in other words, the task is to find the vector u=(u1, u2, …, un), which can, first, satisfy the condition

$$\sum_{j=1}^{n} a_{ij} u_j \in [b_i, B_i]$$

and, second, the difference

$$\sum_{j=1}^{n} a_{ij} u_j - b \qquad (2)$$

is $\forall\ i = \overline{1,m}$ the least one.

The difference (2) can be minimized by means of a fuzzy set [5]

$$F_1 = \frac{B_i - \sum_{j=1}^{n} a_{ij} u_j}{B_i - b_i} : R^n \to [0,1]. \qquad (3)$$

Introducing the marks, the authors come to the following task of planning: to find max un+1 (3) under the condition:

$$\sum_{j=1}^{n} a_{ij} u_j + (B_i - b_i) u_{n+1} < \text{Bi}. \qquad (4)$$

Advantage of such expression of the tasks is obvious: it enables using of common calculating methods to find optimal solutions. In such situation, uncertainty is not a disagreeable peculiarity of the planning task. Probably, that way to use flexibility of fuzzy constraints corresponds to the character of human thinking. The main idea is that many originally fuzzy models can be described in the determined way, and the drawback of the model accuracy is compensated by its flexibility.

Let us transform the task (1), assuming that bi boundary can be changed up to bi + di, where di ≥ 0, while different deviations from bi value get different limits of admissibility (the larger deviation is, the less value of its admissibility is). Such situation is often seen in practice. For instance, a producer is

confident that his/her production requires a purchase of bi raw material at the previously approved price. Besides, he/she considers that it is worth to buy additional amount of the raw material, but it can be without a definite agreement and shipping, and probably, at a higher price.

Such construction can be presented in the following way:

$$a_{i1}u_1 + ... + a_{in}u_n \tilde{\leq} b_i, b_i + d_i, \quad (5)$$

where "soft" correlation " $\tilde{\leq}$ " should be interpreted as "not deteriorating (exceeding), but staying less or equal to bi + di in any case".

Essentially, modern interpretation of the tasks of linear programming has our habit to consider a decision, made by an individual, although it can be made by a group. It is assumed that some individuals have no difficulties to choose advantages. The main difficulty, we try to avoid, concerns collective decision-making, which has more than one system of advantages. Thus, there is a need to consider the way of consolidation of different ideas into an aggregate expression of the choice of advantages.

A more detailed study of the above-mentioned data needs the following fragment situation. Thus, at the private-leased enterprise "Progress" in Kamianka-Buzka district, it is necessary to transform pastures and swamps into gardens and arable land. To implement the task, the enterprise has got 140,000 UAH and 18,000 man-days.

The input data and searched unknown variable are presented in the Table 1.

Table 1. Transformation of lands

№	Lands, subjected to transfor-mation and their area	Projected lands		Costs of transfor-mation of 1 ha (work payment, UAH/costs man-days)	
		gardens	arable land	gardens	arable land
1	Pastures, 150 ha	$\frac{U_{11}}{1{,}220}$	$\frac{U_{12}}{36}$	$\frac{800}{140}$	$\frac{30}{2}$
2	Swamps, 200 ha	-	$\frac{U_{22}}{480}$	-	$\frac{360}{40}$
	Income from 1 ha per a year, UAH)	860	260		

Source: calculated by the authors.

Considering the above-presented data, the target function will look like:

$$Z = 860U_{11} + 260(U_{12} + U_{22}) \to \max \quad (6)$$

$$U_{11} + U_{12} \leq 150, \quad U_{22} \leq 200. \quad (7)$$

Human resource and money constraints:

$$860\ U_{11} + 30\ U_{12} + 360\ U_{22} \leq 140{,}000\ , \quad (8)$$
$$140\ U_{11} + 2\ U_{12} + 40\ U_{22} \leq 18{,}000$$

While calculating the limits of capital investment efficiency, it is possible to determine the ratios r_{ij}. Thus, the standard ρ_H is equal to 0.2, and twenty hryvnias of income are got from one hectare of pastures, whereas ten hryvnias are gained from one hectare of swamp. Considering the above-mentioned, one can calculate

$$r_{11} = 0.2 \cdot 1{,}220 - (860 - 20) = -596,$$
$$r_{12} = 0.2 \cdot 36 - (260 - 20) = -233,$$
$$r_{22} = 0.2 \cdot 480 - (260 - 10) = -154.$$

The limits of capital investment efficiency are measured as:

$$-596U_{11} - 233U_{12} - 154U_{22} \leq 0 \quad (9)$$

The model can also include some other additional constraints. For instance, in the present case, above the mentioned five constraints (7-10), there are also imposed ones, which suggest that not less than 180 ha should be transformed into arable land. That constraint is described as

$$U_{12} + U_{22} \geq 180 \quad (10)$$

Having solved the problem (9) under condition (7–10), the following optimal plan is obtained:

$U_{11}^* = 70.3$ ha; $U_{12}^* = 79.7$ ha;
$U_{22}^* = 200.0$ ha,

and the value of the target function accounts for 133,200 UAH.

The problems of production planning and land transformation optimization are the typical tasks of linear programming. Moreover, fuzziness of the parameter ρ_H causes that the problem of land transformation is considered a fuzzy task of linear programming.

The research argues the well-known and principally new tools, which are based on the modern mathematical instruments (fuzzy sets).

Application of the fuzzy sets secures a more adequate depiction of social-economic conditions of the territory and contributes to effective managerial decisions.

The work presents improved methodic approaches to managerial decision making in the field of land use, basing on fuzzy fundamentals, particularly solution of the tasks of production planning and optimal transformation of lands.

CONCLUSIONS

Thus, land organization is one of the most important components of the system of land relations regulation in Ukraine, because it influences an accurate circulation of lands, formation of the structure of land use and administrative-territorial order, protection of lands, as well as their ecosystem functions, supply of the branches of land resources economy, etc.

However, there should be different approaches to implementation of land organization. Considering the changes, introduced by the land reform into the structure, size and style of agrarian formations' operation, projects of land organization should define the main directions of an enterprise's performance without specification of separate elements and pay maximum attention to ecological constituent of land use.

In Ukraine, implementation of the land reform expects creation of the system of modern flexible and efficient agrarian formations, being capable to employ the whole potential of Ukrainian black land soils.

Under current market conditions, there is an urgent necessity to improve methodological approaches and methodic tools concerning solution of polyvariant tasks of land use with application of mathematical programming.

REFERENCES

[1]Bilyk V.O., Bolharova, N.K., 2001, Strategy of the agrarian reform and its implementation. Economics of AIC, №7.,P. 7-11.

[2]Bohira, M.S., 2017, Application of the data of monitoring for making of managerial decisions. Proceedings from XVIII International scientific and practical forum, scared to the memory of the engineer Yaroslav Zaishlyi Theory and practice of development of agro-industrial complex and rural territories, Lviv: Liha-Pres., P. 220-224.

[3]Bohira, M.S., 2017, Impact of market economy on rational land use. Balanced nature management, №.1,P. 88-91.

[4]Holian, V., 2015, Investments into ecology: sources, forms and reserves of growth. Economist, № 8, P. 7-11.

[5]Kurochkin, V., 2016, Geo-information technology on the base of aerial monitoring, application of controlled ground equipment and processing of the images, http://www.iconfs.net/w. infocom2016/ geoinformatsijna-tekhnologiya-na-osnovi-povitryanogo-monitoryngu-vykorystannya-kerovanoyi-nazemnoyi-tekhniky-ta-obrobky-zobrazhen, Accessed on Dec.20, 2016.

[6]Martyn, A., 2016, Land organization in Ukraine: present day and future. Journal of Land Management, № 8, P.10-13.

[7]Palianychko, N.I., 2017, Scientific fundamentals of formation of financial-economic mechanism of balanced use of agricultural lands. Extended abstract of Doctor's thesis. Kyiv.

[8]Pyrozhkov, V.S., 2016, Economics of nature management should become a strategic direction of economic researches under conditions of the new system of geo-political coordinates and natural-resource restrictions. Economist, № 1, P. 2-3.

[9]Resolution of the CMU of June 7 2017, № 413. Some aspects of improvement of management in the field of use and protection of agricultural lands of the state ownership and their management. June 2017. Journal of Government. 112 p.

[10]Rotshtein, A.P., 1999, Intellectual technologies of identification: fuzzy sets, genetic algorithms, neuron nets. Vinnytsia: Universum-Vinnytsia, 320 p.

[11]Shvorak, A.M., 2016, Consolidation of agricultural lands. Extended abstract of Doctor's thesis. Kyiv, 52 p.

[12]Siavavko, M.S., Rybytska, O.M., 2000, Mathematical modeling under uncertainty conditions. Lviv: Ukraiinski tekhnolohii, 320 p.

[13]Snitynskyi, V.V., 2017, Tasks and prospects of innovative development of higher agrarian education of Ukraine. Proceedings from XVIII International scientific and practical forum, scared to the memory of

the engineer Yaroslav Zaishlyi "Theory and practice of development of agro-industrial complex and rural territories", Lviv: Liha-Pres. P. 5-12.
[14]Sokhnych, A., Bohira, M., Smoliarchuk, M., 2017, Models of the problems in the land use. MOTROL. Commission of Motorization and Energetics in Agriculture, Vol. 19, №1, P. 21 – 24.
[15]Sokhnych A.Ya. Problems of land use and protection under conditions of market economy: monograph. Lviv: NVF Ukraiinski tekhnolohii, 2002. – 252 p.
[16]Sokhnych, A.Ya., 2000, Optimization of land use under conditions of reformation of land relations. Lviv: Ukraiinski tekhnolohii, 108 p.
[17]Stupen, M., 2017, Development of land planning of especially valuable lands in agriculture. MOTROL. Commission of Motorization and Energetics in Agriculture, Vol. 19, № 1, P. 49 – 54.
[18]Trynko, R., 2016, Demographic safety: peculiarities and strategic priorities: monograph. Lviv: Liha-Pres, 204 p.
[19]Volkov, S.M.,2008, Land organization abroad. Journal of Land Management,№ 5, P. 54-59.
[20]Zinchenko, T.Ye., Taratula, R.B., Stupen R.M., 2016, Land and resource potential of recreational territories. Lutsk: Nadstyria, 216 p.