

## IMPROVEMENT OF METHODS OF EXPERT FARMLAND EVALUATION

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**Summary:** Suggestions are given on improving the methods of expert evaluation of farmland plots. Multicriteria choice of generalized groups of land plot properties are used for this purpose. It allows to objectively determine the cost of a land plot, taking into account the specific period of time and unlimited number of indices to characterize it.

**Key words:** land market, price, estimated value, farmland, land plot, expert evaluation of land plots, evaluation methods, multicriteria selection, evaluation criteria, standard plot

### PROBLEM STATEMENT

When land market is functioning, the issue of pricing is important. It is well-known that the market price of land, like any other market commodity, is determined under the influence of the law of supply and demand. It depends entirely on the purchasing power of the buyer, the level of profit which might be obtained from the production on the land. Farming industry, where land is the principal means of production, has been unprofitable over the last 10 years, or, in other words, owners of land plots who were using them for business purposes were not receiving any rent. This has negatively affected the prices of farmland and caused discussion in the society about the expediency of lifting the moratorium on its buying and selling.

The Cabinet of Ministers has approved the methods of expert evaluation of land plots in money terms which aims at the determination of market value of farmland plots by expert means. However, this method cannot be precisely applied to this category of land.

### ANALYSIS OF RECENT STUDIES

The issue of expert evaluation of farmland plots has recently been discussed in the academic circles. An important contribution has been made by Andriychuk, Drapikovskyy, Danylenko, Lyhohrud, Shpychak, Mesel-Vasylyak, Fedorov, Tretyak. They do not object to the use of approaches recognized by the world practice, but they emphasize the necessity to substantiate their application in our conditions.

## TASK SETTING

To suggest methods of expert evaluation of farmland plots based on multicriteria choice in which generalized groups of land plot properties act as criteria.

## THE MAIN MATERIAL

According to expert money evaluation method of land plots it is possible to determine the probable sale price by three approaches adopted in the world practice:

- comparing sale prices for similar land plots,
- capitalization of net income,
- considering the cost of land improvement.

According to the method of expert evaluation of land [45], based on comparing the sale prices for similar land plots, estimated value of a land plot is determined at the sale price level of similar plots using the formula:

$$C_m = C_a + \sum_{\gamma=1}^m \Delta C_{a\gamma}, \quad (1)$$

where  $C_m$  - estimated value of a land plot, determined by comparing the sale price of a similar land plot, Hr;

$C_a$  - sale price of a similar land plot, Hr;

$m$  - the number of factors of comparison,

$\Delta C_{a\gamma}$  - difference (amendment) in the sale price (+, -) of a similar land plot, which is evaluated by  $\gamma$  - factor of comparison.

By this method, the sale prices of the land plots, which by the factors that affect their value to a big extent coincide with the plot which is being evaluated, are taken as the basis for determining the estimated value. The ultimate figure of the estimated value is determined as the average value for ranging options of values (excluding maximum and minimum) or the most common value among the obtained results. The disadvantage of this approach is inability to use it in conditions when there is no active land market. Nowadays, when the farmland market is just emerging and in many cases there is nothing to compare with the price for a plot which is being sold, its application is very limited.

Another methodological approach to expert evaluation of land is based on considering the costs for land improvement.

$$C_M = C_0 - B, \quad (2)$$

where  $C_M$  - nominal value of land (land balance);

$C_0$  - the expected sale price of the land plot;

$B$  - expenses on implementation of improvements on the land plot.

With this approach, the estimated value of a land plot is determined as the balance between the expected sale price of the improved land plot (or capitalized annual income from its use) and the total costs of improvements. The third methodological approach based on capitalization of net income is involved here. It provides for efficient use of a land plot, encumbrances and restrictions of its use being considered. The methodological approach is based on the principle of added profitability which is not linked with land improvements, i.e. the value of a land plot reflects the ability to bring income in future.

When direct capitalization of net income is used, the estimated value of a land plot is determined by the formula:

$$C_m = \frac{D_a}{S_r}, \quad (3)$$

where  $C_m$  - estimated value of a land plot determined by direct capitalization of net income, Hr.;

$D_a$  - the annual net income (actual or expected), Hr.;

$S_r$  - capitalization rate (coefficient).

When indirect capitalization of net income is used, the estimated value of a land plot is determined by the formula:

$$C_m = \sum_{i=1}^t \frac{D_{ai}}{(1 + S_r)^i}, \quad (4)$$

where  $C_m$  - estimated value of a land plot, determined by indirect capitalization of net income, Hr.;

$D_{ai}$  - expected net income for the  $i$ -th year, Hr.;

$t$  - time period in years, which is taken into account under indirect capitalization of net income.

However, application of the above method has its peculiarities.

Firstly, this method can not be used in conditions of unprofitable production on the farmlands. Since 1996 in Ukraine the majority of agricultural enterprises have been unprofitable, and as a result, net income on lands that are in their possession has not been shaped.

Secondly, by this method the value of a land plot is determined by purely economic factors: the general level of prices, the amount of costs on cultivation of a farm crop, obtained net income as well as the percentage of its capitalization. When it comes to farmlands, these economic factors primarily depend on the main means of production - land and its properties. It is the land, provided the land plots are used most effectively, that economic figures - the amount of expenses and income - depend on. That is, the value of a land plot should be determined by the set of characteristics or properties, rather than by economic factors, which are derived from these characteristics and form the basis of the methodological approach.

Thirdly, when evaluating land plots by the method of land capitalization of net income, the amount of the costs on cultivation of a farm crop is an important factor (which directly influences the size of net income). However, due to objective reasons (different level of technical equipment, use of different cultivation technologies, etc.) the prices of the land plots of the same quality are different. And accordingly, the price of a particular land plot determined by this method is different, though it should be the same.

Fourthly, nowadays there is no information on farm crop yields, the costs of growing these crops specifically on a particular land plot.

The carried out analysis of methodological approaches proves that it is impossible to use the foreign experience of evaluation of farmland alone. Since their economic management conditions do not correspond with our conditions of the transition period, this encourages the development of the methodological approaches, which could eliminate the mentioned disadvantages and provide a reliable determination of the real cost of land by the expert way.

Expert evaluation of farmland by multi criteria selection anticipates: determining the value of a hypothetical standard land plot; calculation by quantitative methods of the importance of the criteria of a share of each standard index in the value of the given land plot; comparison of the real indices of the plot under evaluation with the standard ones and the calculation of their value,

summing up the obtained values of money evaluation of each index and determination of the real price of the plot.

The suggested way of expert land plot evaluation provides for conducting single, consistently performed operations which in their combination make up the procedure of calculating its value. Let us consider the principle of the calculation.

The implementation of the proposed method starts with the determining of the cost of a hypothetical standard plot. Hypothetical standard plot is a one-hectare land parcel, which is characterized by the highest (for a particular soil and climatic zone) indices of fertility, ecological condition, sufficiently high level of engineering improvement and an ideal location. Its value is supposed to be determined using the formula (2) by the method of capitalization of net income which is obtained by cultivation (for example) of winter wheat. The choice of this farm crop is proved by the fact that it takes the largest part in the structure of farm crops and is grown in each soil and climatic zone of Ukraine with no exceptions. However, the determination of a standard value of a land plot can as well be done under conditions of natural agricultural area of the region producing the most commonly cultivated farm crop, which is characterized by the highest crop yield.

Yield of winter wheat in the country is now considered to be 40 kg / ha with normative expenses 1900 Hr. Thus, at stock market price of 60 Hr/cwt., which prevails in the market of farm products, and net income capitalization rate of 3% (ideal rate of capitalization), the cost of a hypothetical standard hectare will be:

$$B_{\text{стан}} = \frac{40 \cdot 60 - 1900}{3} \cdot 100 = 16600 \text{ грн.} \quad (5)$$

The next step in the process of expert evaluation is the calculation by quantitative methods of the importance of the criteria for the share of each standard index in the value of the plot under evaluation. One of such methods is to construct a matrix of coefficients of advantages when the criteria are compared in pairs. If criterion  $U_i$  is more important than  $U_j$ , the coefficient is equal to 1.5, at their equal importance - 1.0, but if it is less important - 0.5. In the proposed method the coefficients of importance for fertility parameters are determined ( $U_1$  Humus content, capacity of humus horizon, physical clay content, movable phosphorus content mg / kg; lightly hydrolyzed nitrogen content, mg / kg, movable potassium contents, mg / kg). While comparing in pairs, advantage coefficient  $K_{ij}$  of the criterion in line with respect to the criterion in column is given (Table 3.8).

The coefficients of the criteria value are calculated by the formula:

$$\lambda_i = \frac{P_{ij}}{\sum P_{ij}}, \quad (6)$$

where  $P_{ij}$  value is derived from the sum of products of each element of the line multiplied by the elements of the vector-column  $\sum K_{ij}$ . For example, for the first line:

$$\begin{aligned} P_{11} &= K_{11} \sum K_{11} + K_{12} \sum K_{12} + K_{13} \sum K_{13} + K_{14} \sum K_{14} + K_{15} \sum K_{15} + K_{16} \sum K_{16} \\ &= 7,5 \cdot 1 + 8,5 \cdot 0,5 + 5,0 \cdot 1,5 + 5,0 \cdot 1,5 + 4,5 \cdot 1,5 + 5,0 \cdot 1,5 = 41 \end{aligned} \quad (7)$$

Having made up matrix and having arranged criteria (figures) in the order of their importance, the significance coefficients of each of them are determined by the value of  $\lambda$ . That is, by  $\lambda$  the place of the criterion in the rank is defined.

Table 1. Values of significance coefficients of the estimated indices in the expert evaluation by multicriteria choice

№	Indices	$U_1$	$U_2$	$U_3$	$U_4$	$U_5$	$U_6$	$\Sigma K_i$	$P_{\Sigma}$	$\lambda_i$	Rank
$U_1$	Humus content, %	1,0	0,5	1,5	1,5	1,5	1,5	7,5	41,0	0,209	2
$U_2$	Capacity of humus horizon, m	1,5	1,0	1,5	1,5	1,5	1,5	8,5	49,0	0,248	1
$U_3$	Physical clay content, %	0,5	0,5	1,0	1,0	1,0	1,0	5,0	27,5	0,139	3
$U_4$	Movable phosphorus content, mg/kg	0,5	0,5	0,5	1,0	1,5	1,0	5,0	27,25	0,138	4
$U_5$	Slightly hydrolyzed nitrogen content, mg/kg	0,5	0,5	0,5	1,0	1,0	1,0	4,5	25,0	0,128	6
$U_6$	Mobile potassium content, mg/kg	0,5	0,5	0,5	1,0	1,5	1,0	5,0	27,25	0,138	5
Total		-	-	-	-	-	-	-	197,0	1	-

In the above example the analysis was conducted with a defined number of indices of one of the groups and it shows only the order of the calculation of coefficients of significance. In conducting expert evaluation a large number of criteria can be taken into consideration as well. The bigger the set, the more indices will be considered, and as a result – the more accurate the expert evaluation will be. The procedure for determining the significance coefficients for any number of criteria is similar to the one provided in the Table.

The concept of physical essence of significance coefficients is important. In this case, they are the price share of each considered standard index of a standard plot of land in its total value.

Considering the influence of the significance coefficients values on the price of land plot, the share of each of them in the total value of the hypothetical standard hectare is identified, the share being expressed in hernias. The calculation is carried out using the formula:

$$C_{\text{гек}} = B_{\text{гек}} * \lambda \quad (8)$$

On the bases of the obtained results as well as on the determined value of a hypothetical standard hectare, the shares made up by each single index in the general cost of a land plot are calculated (Table 2).

Table 2. A share of estimated indices in the price of a standard hectare of land and its total amount

Index	Index	Numeric value of the index of a standard plots, $U_{\text{std}}$	Significance coefficients, $\lambda$	Standard index price, $C_{\text{std}}$ , Hr
$U_1$	Humus content, %	6.26,2	0.2090,209	3469.43469,4
$U_2$	Capacity of humus horizon, m	0.400,40	0.2480,248	4116.84116,8
$U_3$	Physical clay content, %	4040	0.1390,139	2307.42307,4
$U_4$	Mobile phosphorus content, mg/kg	250250	0.1380,138	2290.82290,8
$U_5$	Slightly hydrolyzed nitrogen content, mg/kg	225225	0.1280,128	2124.82124,8
$U_6$	Mobile potassium content, mg/kg	170170	0.1380,138	2290.82290,8
Total		—	11	1660016600

The next step in conducting expert evaluation by the proposed method is the determination of the price of a specific land plot by multicriteria choice. It is based on the comparing of the set of defined fertility indices, which rather fully describe its condition, with the standard ones and, on this basis, the determination of their partial cost impact. The sum in money terms of each of the determined indices (properties) of the estimated plot will make its expert price.

Calculation of the share, which is made up by each particular index in the total cost of the land plot, is done by the following formula:

$$C_i = \frac{U_i C_{\text{std}}}{U_{\text{std}}}, \quad (9)$$

where  $C_i$  - the share in expert value of the land plot of  $i$  index,

$C_{\text{std}}$  - the share of a standard index in the price of a hypothetical standard land plot,

$U_i$  - numeric value of  $i$  index,

$U_{\text{std}}$  - standard value of an index.

Having summed up fertility indices expressed in money terms, the cost of a land plot is determined. But it ignores the parameters of environmental impact, geological and morphological conditions, location and engineering improvement of the territory. Their influence is determined by means of multiplying the determined price by the coefficients of influence of each of the factors. Then the formula for determining the expert cost of a land plot will be the following:

$$C_{\text{sum}} = C_i \cdot K_1 \cdot K_2 \cdot K_3 \cdot K_4 \quad (10)$$

where  $K_1$  - the coefficient of the environmental state,

$K_2$  - the coefficient of geological and geo-morphological parameters,

$K_3$  - the location coefficient,

$K_4$  - the coefficient of engineering improvement of the territory.

## CONCLUSIONS

In conducting expert evaluation by multicriteria choice at each stage the most important is the role of the expert. Choosing a set of criteria and determining their importance, the procedure of finding the share of the estimated indices (criteria) in the total cost of the estimated land plot is determined by his or her personal and professional qualities, by his or her understanding the task, his or her knowledge and experience.

By this methodological approach one can estimate the cost of a landnumber of indices which characterize it. In addition, it can be used to calculate the right expert price of a land plot depending on the ways and purpose of its use. Under these conditions, single indices, the significance of which (different for each case) an expert can determine right using this method, are determinant in price formation. By this method, evaluation of land plots can be done with regard to a specific period of time, because the cost of a hypothetical standard plot, determined by the price level prevailing at this period of time on the farm product market as well as by the level of presently existing technologies of cultivating farm crops, altogether determine the profitability of farming.

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## DOSKONALENIE METOD FACHOWEJ WYCENY ZIEMI ORNEJ

**Streszczenie.** W artykule zaproponowano metody wyceny działek rolnych przez ekspertów w oparciu o wybrane kryteria bazujące na uogólnionych grupach cech danej działki. Przy takiej metodzie wyceny możliwa jest kalkulacja wiarygodnej ceny użytków rolnych w zależności od przeznaczenia i sposobów wykorzystania danej działki.

**Słowa kluczowe:** rynek ziemi, cena, szacunkowa wartość, użytki rolne, działka, fachowa wycena działek, metody wyceny, liczne kryteria wyboru, kryteria wyceny, standardowa działka