IMPROVEMENT OF METHODS OF THE PROPERTY VALUATION BASED ON MATHEMATICAL AND NUMERICAL MODELING

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Abstract

The conducted researches aimed to analyze modern models and methods of implementation of the comparative approach in property and real estate appraisal, to investigate and evaluate their effectiveness, to suggest ways of further improving the methods of property valuation.

To achieve this aim, the authors carried out a series of computational experiments on a computer. The essence of these experiments was the comparative evaluation of the cost of test properties based on the following methods: expert evaluation, solving systems of linear algebraic equations, based on the normalized distances in the space of pricing factors and the correlation-regression method. An analysis was made of the influence of methods of digitizing the initial data (pricing factors) on the final cost of real estate.

On the basis of the studies, prospective ways and directions for further improvement of the methods of property valuation are determined.

Keywords: real estate, valuation of property and real estate, digitization of source data, property valuation method, comparative approach in real estate appraisal, real estate value.

1. Introduction

In conditions of active reformation of property relations, the need for services for valuation of property and property rights is regularly growing. The problems of property valuation related to property alienation, property disputes, the problem of land reform, the formation of an alternative model of partnership between the public and private sectors, require objective decisions of the appraisal expertise [1–6]. Accordingly, there is a need to improve the toolkit of the procedure for conducting property valuation by applying modern mathematical models and methods to obtain an objective market value of property and to make effective management decisions.

2. Literature review and problem statement

To date, property valuation in Ukraine [7], as in the countries of Europe [5], Australia [6] is conducted according to 3 main approaches: comparative, profitable and costly, each of which has advantages and disadvantages (**Table 1**).

Table 1
Comparative analysis of different approaches to property valuation

Approach	Advantages	Disadvantages
profitable	– the cost of the valuation depends on the profit that the valuated object can generate – takes into account the market aspect through the discount rate; – takes into account the economic aging; – is universal.	– cumbersome calculations; – the results are of a probabilistic nature; – the difficulty of obtaining information for making calculations; – high degree of risk; – valuation subjectivity.
comparative	– a completely market-based method; – in the total cost reflects the opinion of typical sellers and buyers; – allows to take into account the uniqueness of each object; – simplicity of interpretation of results.	– does not take into account future expectations; – dependence on market stability; – the complexity of reconciling sales data is significantly different; – cumbersome calculations; – the possibility of the absence of analogical objects; – difficulties in gathering the necessary initial information.
costly	– is based on real assets; – the only possible for some types of enterprises; – allows to display the actual costs incurred by the enterprise [5].	– does not take into account future expectations; – does not take into account some intangible assets; – does not take into account the effectiveness of the use of assets; – the book value of the property never corresponds to its market value.

To date, for the valuation of property and real estate, the most common is the comparative approach, which involves determining the value of the valuated object by comparing the prices of recent sales of similar properties. The approach is based on taking into account the principles of supply and demand in the real estate market.

This approach is implemented in 4 stages [7]:

1. Study of the state, development trends and features of the real estate market segment to which the valuated object belongs.

2. Collection and verification of information about analogical objects, analysis of collected information.

3. Choosing a method for implementing a comparative approach.

4. Reconciliation of adjusted prices of analogical objects and determination of the value of the market value of the property being valued.

One of the most difficult stages in implementing a comparative approach in valuation of property and real estate is the stage of choosing the method of its implementation (stage 3), which requires the definition of certain scientifically grounded criteria for choosing a particular method.

Therefore, it is important to analyze modern methods of implementing a comparative approach in valuation of property and real estate, assess the effectiveness of existing methods and models, and offer the most effective tools for performing valuation activities.

3. The aim and objectives of research

The conducted researches aimed to analyze modern models and methods of implementation of the comparative approach in property and real estate appraisal, to investigate and evaluate their effectiveness, to suggest ways of further improving the methods of property valuation.

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To achieve this aim, the following tasks are solved in the work:

– to conduct an analysis of methodological approaches to the valuation of property and real estate;

– to analyze the methods of implementing a comparative approach in the valuation of property and real estate;

– to conduct a comparative analysis of the calculation of the property value on the basis of expert valuation methods, solving the system of linear equations, the method of calculating corrective corrections based on the normalized distances in the space of pricing factors and on the basis of the correlation-regression method;

– to carry out computational experiments to investigate the effect of the process of digitizing the original data on the final value of the real estate object when implementing the studied methods.

4. The essence and methods of research of modern methods of implementing a comparative approach in valuation of property and real estate

4. 1. Object, subject and methods of research

The objects of this research are real estate objects.

The subject of this research is methods for determination of the value of real estate objects in the framework of a comparative approach.

Research methods are mathematical and numerical modeling.

The research is carried out in two main directions:

1. Computational experiment on the study of existing methods for implementing a comparative approach in the valuation of property and real estate, the essence of which was the comparative valuation of test real estate objects obtained by different methods.

2. Computational experiment to study the sensitivity of the methods under consideration to implement a comparative approach in the valuation of property and real estate according to the procedure for digitizing the initial data (pricing factors).

4. 2. Investigated methods for implementing a comparative approach in valuation of property and real estate

Expert method of determining corrective corrections

The simplest and most popular method for implementing a comparative approach in real estate valuation is the expert method of determining corrective amendments. It is based on making corrections to the cost of analogical objects for certain pricing factors, by comparing them with the valuation object. Most often, amendments are introduced to: terms of sale, location, technical condition and others. At the same time, a certain step is chosen, based on the vision of a specific expert. Most often this step is 5 %. The final value of the valuation object is derived as the arithmetic mean, modal or median value [2–4, 6].

It is clear that this method is very dependent on the qualification of the expert and the choice of the calculated step.

The method of calculating corrective corrections based on the solution of a system of linear algebraic equations (SLAE)

The method of calculating corrective corrections based on the solution of a system of linear algebraic equations (SLAE) is more substantiated and formalized [6–8]. According to this method, the value of the property is based on the formula:

$$V_0 = P_i + \sum_{i=1}^{m} \Delta P_{ij}, \qquad (1)$$

where V_0 – the value of the valuation object, P_i – the price of the i-th counterpart; ΔP_{ij} – adjustment of the price of the i-th analogue to the difference in the object of estimation by the j-th pricing factor.

According to the model (1), it is necessary to compare the object in succession with each of the selected analogs. As a result, let's obtain a system of linear equations:

$$\begin{cases} V_0 - \Delta x_{11}\Delta P_1 - \Delta x_{12}\Delta P_2 - ... - \Delta x_{1m}\Delta P_m = P_1; \\ V_0 - \Delta x_{21}\Delta P_1 - \Delta x_{22}\Delta P_2 - ... - \Delta x_{2m}\Delta P_m = P_2; \\ ... \\ V_0 - \Delta x_{n1}\Delta P_1 - \Delta x_{n2}\Delta P_2 - ...\Delta x_{nm}\Delta P_m = P_n. \end{cases} \tag{2}$$

It is more convenient to find the solution of this system by the matrix method.

The main drawback of this method is that the number of analogs should exceed by 1 number of factors. This certainly causes certain difficulties in the implementation of this method, related to the need to search for additional analogues or a reduction in the number of pricing factors.

The method of calculating corrective corrections based on the normalized distances in the space of pricing factors

Another formalized method has no limitations on the number of pricing factors and analogical objects is the method of calculating corrective corrections based on the normalized distances in the space of pricing factors [8]. According to it, the definition of the value of the property is carried out in 4 stages.

Preparatory stage. At this stage, the state matrix M is formed:

$$M = \begin{pmatrix} x_{01}x_{02} & \cdots & x_{0m} \\ \vdots & \ddots & \vdots \\ x_{n1}x_{n2} & \cdots & x_{nm} \end{pmatrix}, \tag{3}$$

where n is the number of analogical objects; $x_{01}, x_{02}, ..., x_{0m}$ – the object of valuation; $x_{n1}, x_{n2}, ..., x_{nm}$ – i-th analogue.

The first stage is the formation of a matrix of congruences

At this stage, let's form the matrix of comparisons ΔM by subtracting the value of the first row of the matrix from the corresponding elements of all subsequent rows:

$$\Delta M = \begin{pmatrix} \Delta x_{11}\Delta x_{12} & \cdots & \Delta x_{1m} \\ \vdots & \ddots & \vdots \\ \Delta x_{n1}\Delta x_{n2} & \cdots & \Delta x_{nm} \end{pmatrix}. \tag{4}$$

Thus, each element of the comparison matrix Δx_{ij} characterizes the difference between the i-th analogue object and the object of estimation by the j-th factor.

The second stage is the normalization of the matrix of congruences

In order to move away from the different units of measurement of the columns of the matrix ΔM, each element of the matrix is normalized as follows:

$$\Delta k_{ij} = \frac{\Delta x_{ij}}{\sqrt{\sum_{i=1}^{n}\left(\Delta x_{ij}\right)^2}}. \tag{5}$$

Thus, let's obtain a normalized comparison matrix $+\Delta M$.

The third stage is the determination of weight coefficients

On the basis of the matrix $+\Delta M$ let's calculate the distance l_i from the formula:

$$l_i = \sqrt{\sum_{j=1}^{m}\left(\Delta k_{ij}\right)^2}, \ i = \overline{1,n}. \tag{6}$$

In an n-dimensional Euclidean space, the object of estimation acts as the center of coordinates, and to each analogue object there corresponds a separate point, remote from the center of coordinates (the object of valuation) by the distance l_i.

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To each quantity l_j it is possible to compare the reciprocal quantity $P_i = \dfrac{1}{l_i}$, which can be transformed into a weighting coefficient by the formula:

$$v_i = \frac{p_i}{\sum p_i}. \tag{7}$$

The fourth stage is the determination of the value of the valuation object. Taking into account the found weight coefficients, the value of the valuation object is determined by the formula:

$$C = \sum_{i=1}^{n} v_i \cdot C_i, \tag{8}$$

where C_i – the cost of the i-th analogue object.

This method is guaranteed to give the result of the value of the valuation object, does not exceed the limits of the cost of used analogs.

The advantage of this method is that it takes into account the degree of proximity of the valuation object to the analogue objects.

Correlation-regression method for determining the value of real estate objects

If there is a significant amount of information on analogous objects, then it is reasonable to determine the market value of a real estate object within the framework of a multifactor regression analysis that allows one to assess the degree of influence on the investigated performance indicator of each of the factors introduced into the model with a fixed position at the middle level of other factors [9–18].

Mathematically, the task is reduced to finding an analytical expression, it would better reflect the connection of the factor characteristics with the resultant:

$$Y = f\left(X_1, X_2, ..., X_n\right). \tag{9}$$

The most difficult problem is choosing the form of communication. However, taking into account that any function of many variables can be reduced to a linear form by logarithmation or substitution of variables, the multiple regression equation can be expressed in a linear form:

$$Y = a_0 + a_1 X_1 + a_2 X_2 + ... + a_n X_n, \tag{10}$$

where Y – the calculated values of the effective indicator; X_1, X_2, …, X_n – the factors; a_0, a_1, a_2,…a_n – the equation parameters.

The equation parameters are calculated by the least squares method. So, in the case of two-factor regression:

$$
\begin{aligned}
\sum Y &= na_0 + a_1 \sum X_1 + a_2 \sum X_2 \\
\sum YX_1 &= a_0 \sum X_1 + a_1 \sum X_1^2 + a_2 \sum X_1 X_2 \\
\sum YX_2 &= a_0 \sum X_2 + a_1 \sum X_1 X_2 + a_2 \sum X_2^2
\end{aligned}
\tag{11}
$$

Each coefficient of the equation indicates the degree of influence of the relevant factor on the score for a fixed position of other factors.

In order to identify the relative strength of the influence of individual factors and their reserves, it is advisable to calculate the partial elasticity coefficients and beta coefficients by the formulas:

$$\varepsilon_э = a_i \frac{\overline{X_i}}{\overline{Y}}; \beta_э = a_i \frac{\sigma_{X_i}}{\sigma_Y}, \tag{12}$$

where a_i – coefficients of regression at the i-th factor; $\overline{X}_i$ – the average value of the i-th factor; $\overline{Y}$ – the average value of the effective indicator; σ_{X_3} – the standard deviation of the i-th factor; σ_Y – the standard deviation of the result.

Partial coefficients of elasticity show how many percent the result on the average will change with 1 % change of each factor for a fixed position of other factors.

5. Analysis of the results of a computational experiment on the methods of realizing the comparative approach in real estate valuation

In order to valuate and compare various methods of calculating the value of real estate in the comparative approach, a number of test cases are examined, a fragment of one of which is given below.

Let's suppose that it is necessary to evaluate the property (living quarters), which is characterized by the indicators shown in **Table 2**. For comparison, 5 analogical objects are selected, the characteristics of which are also given in **Table 2**. Let's assess the value of the object for such pricing factors: technical condition, location, availability of improvement, the presence of a parking slot.

Table 2
Output data on the subject of valuation and analogical objects

No.	technical condition	Location	Accomplishment	Parking slot	The cost of 1 sq.m, UAH
Valuation object	good	Central	water supply lighting	yes	
Analogue 1	good	Central	all the benefits	yes	13500
Analogue 2	excellent	middle	all the benefits	yes	13500
Analogue 3	satisfactory	middle	water supply lighting	no	12900
Analogue 4	satisfactory	middle	lighting	yes	12850
Analogue 5	satisfactory	Central	without accomplishment	yes	12900

According to the expert method of calculating the cost of the valuated object, a standard step of 5 % was chosen. As a result of the calculations, the following results are obtained (**Table 3**).

Table 3
Result of calculation of cost of valuated object by a method of an expert estimation

No.	Corrective amendments, %			Amount of amendments, %	Adjusted cost of 1 sq. m, UAH
Analogue 1	0	–5	0	–5	12825
Analogue 2	5	–5	0	–5	12825
Analogue 3	5	0	5	15	14835
Analogue 4	5	5	0	15	14777,5
Analogue 5	0	10	0	15	14835
Object	average				14019,5
	median				14777,5

Further, the cost of the same property is calculated using the SLAU solution method. For this purpose, the initial data were digitized (**Table 4**).

As a result of the implementation of this method, a solution is obtained in this form (**Table 5**).

Element V_0 – this is the market value of 1 square. m (for the estimated property – 13362.5 UAH.).

Other elements of the obtained matrix V can be interpreted as follows:

ΔP_1 =187,5 UAH – correction to the cost of 1 square. m of the property while improving its technical condition by one point;

ΔP_2=187,5 UAH – correction to the cost of 1 square. m of the property with a hypothetical improvement in its location by one point;

ΔP_3=137.5 UAH – correction to the cost of 1 square. m of the property while improving the improvement;

ΔP_4=87.5 UAH – correction to the cost of 1 square. m of the property when there is a parking lot.

In order to reveal the dependence of the choice of the method of digitizing the initial data on the final cost of the valuation object, a computational experiment is carried out, a fragment of the results of which are given in **Table 6**. In the course of the experiment it turned out that the method of digitizing data in this method affects the final result of the cost. In this case, even corrections may occur with a negative sign, contrary to the physical meaning of the problem.

Table 4
Initial data for calculating the value of an object by the SLAU solution method

pricing factor	Technical condition (TC)	Location (L)	Accomplishment (A)	Park slot (PS)
		Ranking		
0				Yes
1	Satisfactory	outskirts	without accomplishment	No
2	Good	middle	lighting	
3	Excellent	Central	water supply lighting	
4			all the benefits	
Output factors (pricing factors)				
Valuation object	2	3	2	1
Analogue 1	2	3	3	1
Analogue 2	3	2	3	1
Analogue 3	1	2	2	0
Analogue 4	1	2	2	1
Analogue 5	1	3	0	1

Table 5
The result of calculating the value of the property by the method of SLAU solution

State matrix					Inverse matrix					Vector of values, UAH
1	0	0	1	0	0,5	0,25	0	−0,25	0,5	13362,5
1	1	−1	1	0	−0,5	0,75	0	−0,75	0,5	187,5
1	−1	−1	0	−1	0,5	−0,25	0	−0,75	0,5	187,5
1	−1	−1	−1	0	0,5	−0,25	0	0,25	−0,5	137,5
1	−1	0	−2	0	0,5	−0,25	−1	1,25	−0,5	87,5

Further, the cost of this real estate object is calculated by determining the weight coefficients based on the normalized distances in the space of the pricing factors. For this purpose, data are digitized similar to the previous method and calculations are performed. The obtained results can be interpreted as the value of the object of valuation and the degree of remoteness of the object from the analogical objects (**Table 7**).

To determine the dependence of the choice of the method of digitizing data on the final cost of the valuation object, a computational experiment is conducted to study this method, a fragment of the results of which are given in **Table 8**. In the course of the experiment it turned out that the method of digitizing data in this method also affects the final result of the value of the valuation object (**Table 8**).

Table 6

Fragment of the results of the computational experiment on the investigation of the method of SLAU solution in valuation of the real estate object

Object	Output data					Calculation result, UAH
	Pricing factors				Cost, UAH	
	TC	L	A	PS		
Experiment 1						
Valuation object	2	3	2	1		
A1	2	3	3	1	13500	13362,5
A2	3	2	3	1	13500	187,5
A3	1	2	2	0	12900	187,5
A4	1	2	1	1	12850	137,5
A5	1	3	0	1	12900	87,5
Experiment 2						
Valuation object	3	3	2	1		
A1	3	3	3	1	13500	13268,8
A2	5	2	3	1	13500	93,75
A3	1	2	2	0	12900	187,5
A4	1	2	1	1	12850	137,5
A5	1	3	0	1	12900	87,5
Experiment 3						
Valuation object	2	5	3	1		
A1	2	5	5	1	13500	12900
A2	3	3	7	1	13500	−87,5
A3	1	3	3	0	12900	93,75
A4	1	3	1	1	12850	137,5
A5	1	5	0	1	12900	225

Table 7

Calculation of the value of the property by determining the weighting coefficients on the basis of the normalized distances in the space of the pricing factors

Object	$\sum_{j=1}^{4}\left(\Delta k_{ij}\right)^2, i=\overline{1,n}$	$l_i=\sqrt{\sum_{j=1}^{4}\left(\Delta k_{ij}\right)^2}, i=\overline{1,n}$	$p_i=\dfrac{1}{l_i}$	$v_i=\dfrac{p_i}{\sum p_i}$	Cost, UAH
A1	1,14	1,07	0,94	0,15	2049,768
A2	1,41	1,19	0,84	0,14	1846,032
A3	0,36	0,60	1,68	0,27	3506,582
A4	0,50	0,71	1,42	0,23	2955,381
A5	0,60	0,77	1,29	0,21	2703,884
Sum			6,17	1,00	13061,65

Table 8

Fragment of the results of the computational experiment on the study of the method of determining the weight coefficients on the basis of the normalized distances in the space of the pricing factors

Object	Output data					Calculation	
	Pricing factors				Cost, UAH	Weight coefficients	Cost, UAH
	TC	L	A	PS			
Experiment 1							
O	3	3	3	1			
A1	3	3	4	1	13500	0,15	2049,768
A2	5	2	4	1	13500	0,14	1846,032
A3	1	2	3	0	12900	0,27	3506,582
A4	1	2	2	1	12850	0,23	2955,381
A5	1	3	1	1	12900	0,21	2703,884
Sum						1,00	13061,65
Experiment 2							
O	3	3	2	1			
A1	3	3	3	1	13500	0,16	2201,839
A2	5	2	3	1	13500	0,14	1954,778
A3	1	2	2	0	12900	0,33	4207,167
A4	1	2	1	1	12850	0,25	3170,576
A5	1	3	0	1	12900	0,21	2754,347
Sum							14288,71
Experiment 3							
O	2	4	2	1			
A1	2	4	3	1	13500	0,16	2100,039
A2	3	5	3	1	13500	0,13	1774,683
A3	1	3	2	0	12900	0,25	3251,81
A4	1	3	1	1	12850	0,21	2693,404
A5	1	3	0	1	12900	0,21	2754,347
Sum							12574,28

Next, the cost of the property is calculated using the correlation-regression method (**Table 9**).

Table 9

Calculation of the value of the real estate object by the correlation-regression method

Object	X_1	X_2	Y	YX_1	YX_2	X_1^2	X_2^2	Y^2	X_1X_2
A1	3	4	13500	40500	54000	9	16	182250000	12
A2	4	3	13500	54000	40500	16	9	182250000	12
A3	2	3	12900	25800	38700	4	9	166410000	6
A4	2	3	12850	25700	38550	4	9	165122500	6
A5	2	4	12900	25800	51600	4	16	166410000	8
Sum	13	17	65650	171800	223350	37	59	862442500	44
Average	2,6	3,4	13130	34360	44670	7,4	11,8	172488500	8,8
	Determinant X				**Determinant X1**			**Solution of the system**	
5	13	17	65650	65650	13	17		a0	a1	a2
13	37	44	171800	171800	37	44		11600	357,9	176,3
17	44	59	223350	223350	44	59		Object cost, UAH		
19				220400				13378,95		

A computational experiment to investigate the correlation-regression method shows that the choice of the method of digitizing the initial data practically does not affect the final result of the cost, which is by far the most significant advantage of this method (**Table 10**).

Table 10

Fragment of the results of a computational experiment on the investigation of the correlation-regression method of property valuation

	X_1	X_2	Y	YX_1	YX_2	X_1^2	X_2^2	Y^2	X_1X_2
Experiment 1									
O	3	4							
A١	3	4	13500	40500	54000	9	16	1,82E+08	12
A٢	4	3	13500	54000	40500	16	9	1,82E+08	12
A٣	2	3	12900	25800	38700	4	9	1,66E+08	6
A٤	2	3	12850	25700	38550	4	9	1,65E+08	6
A٥	2	4	12900	25800	51600	4	16	1,66E+08	8
Sum	13	17	65650	171800	223350	37	59	8,62E+08	44
Average	2,6	3,4	13130	34360	44670	7,4	11,8	1,72E+08	8,8

Valuation object, UAH

13378,95

	X_1	X_2	Y	YX_1	YX_2	X_1^2	X_2^2	Y^2	X_1X_2
Experiment 2									
O	3	3							
A1	3	3	13500	40500	40500	9	9	1,82E+08	9
A2	5	2	13500	67500	27000	25	4	1,82E+08	10
A3	1	2	12900	12900	25800	1	4	1,66E+08	2
A4	1	2	12850	12850	25700	1	4	1,65E+08	2
A5	1	3	12900	12900	38700	1	9	1,66E+08	3
Sum	11	12	65650	146650	157700	37	30	8,62E+08	26
Average	2,2	2,4	13130	29330	31540	7,4	6	1,72E+08	5,2

Valuation object, UAH

13378,95

	X_1	X_2	Y	YX_1	YX_2	X_1^2	X_2^2	Y^2	X_1X_2
Experiment 3									
O	4	3							
A1	4	3	13500	54000	40500	16	9	1,82E+08	12
A2	5	2	13500	67500	27000	25	4	1,82E+08	10
A3	3	2	12900	38700	25800	9	4	1,66E+08	6
A4	3	2	12850	38550	25700	9	4	1,65E+08	6
A5	3	3	12900	38700	38700	9	9	1,66E+08	9
Sum	18	12	65650	237450	157700	68	30	8,62E+08	43
Average	3,6	2,4	13130	47490	31540	13,6	6	1,72E+08	8,6

Valuation object, UAH

13378,95

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6. Discussion of the research results on methods for implementing a comparative approach in real estate valuation

To date, the main methods that implement a comparative approach in the valuation of property and real estate is the method of expert evaluation, the method of calculating corrective corrections based on the solution of a system of linear equations, the method of calculating corrective corrections based on the normalized distances in the space of pricing factors, and the correlation-regression method.

Comparison of the results of calculations of the value of the object valuation by various methods has shown that the expert method, as the most subjective, gives the most overestimated value of real estate objects; the method of SLAE solution and the method of determining the weight coefficients on the basis of the normalized distances in the space of the pricing factors show a somewhat understated valuation (**Fig. 1**).
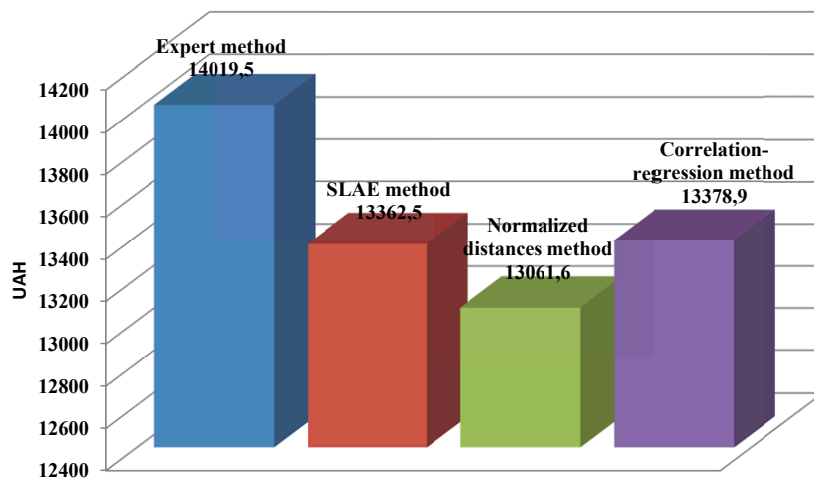
Fig. 1. The results of calculating the value of the property by different methods

In addition, the analysis of the results of a computational experiment on the influence of methods of digitizing the initial data on the final value of the real estate object when implementing various methods has shown that the method of calculating corrective corrections based on the solution of a system of linear equations and the method of calculating weight coefficients on the basis of the normalized distances in the space of pricing factors essentially depend on the method of digitizing the initial data, while the correlation-regression method does not exert addiction is without suspended its advantage.

7. Conclusions

Valuation of property and property rights is an important prerequisite for the functioning and development of civilized market relations. Therefore, the problems associated with the improvement of valuation and appraisal activity are always topical.

Modern practice of valuation of real estate has a significant methodological and calculating apparatus for making sound management decisions. However, the proposed economic and mathematical models in most are aimed at reflecting the general trends in the development of the real estate market, while the real estate market is characterized by variability and multifactoriness, which makes it necessary to take into account its stochastic nature in computational models.

On the basis of the research carried out in the work, it can be concluded that today the most expedient in valuation of real estate is the development and improvement of methods of correlation and regression analysis, it allows not only to determine the current market value of real estate objects, but also to establish investigative causality. Obligations between pricing factors , predicting qualitative and quantitative changes in the real estate market, is an integral part in making the most effective management solutions.

The methods and results of scientific research presented in this work are used in the evaluation of real residential and non-residential real estate LLC "Tasador" (Kyiv, Ukraine).

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