UDC 625.7/.8:330.522:330.43
DOI: 10.15587/2312-8372.2020.200743

Slavinska O.,
Kharchenko A.,
Bubela A.,
Chechuha O.

DEVELOPMENT OF ROAD SECTOR'S LEND VALUATION METHOD FOR AIMS OF ASSET MANAGEMENT

Об'єктом дослідження є процеси управління земельним фондом дорожнього господарства. Представлена робота ґрунтується на використанні мультиструктурного підходу, основних принципах теорії складних систем та на методології AHP (Analytic Hierarchy Process) Томаса Саати. Головною гіпотезою дослідження є застосування мультиструктурного підходу до оцінки активів, які у дослідженні оцінюються не комплексно, а розглядаються як складні об'єкти та розбиваються на більш прості рівні, складові та елементи, що можуть бути оцінені окремо. Розглянуті особливості вартісної оцінки земель дорожнього господарства, а також визначені основні етапи послідовності оцінювання. Встановлено, що вартісна оцінка земельної ділянки є основною складовою оцінювання вартості активу дорожнього господарства, який розміщений на ній. Результати теоретичного дослідження дозволили розробити метод вартісної оцінки земель дорожнього господарства для цілей управління активами. Розроблений алгоритм має чітку послідовність формування методології оцінки земель дорожнього господарства, що дозволяє обґрунтувати прийняття управлінських рішень щодо земельної ділянки, які узгоджені з цілями та відповідають характеру задач функціонування й розвитку дорожнього господарства. Апробацію розробленого алгоритму виконано на реальному прикладі. З'ясовано, що цей метод дозволяє оптимізувати процес вартісної оцінки та управління дорожніми активами, що особливо важливо в межах обмежених фінансових ресурсів. Вибір варіантів вартісної оцінки земель базується на критеріях економічної ефективності, виходячи з основних особливостей оцінки земель дорожнього господарства. Результати розрахунків можуть бути підґрунтям формулювання управлінських цілей щодо активів дорожнього господарства.

Ключові слова: *управління активами, вартісна оцінка, дорожнє господарство, земельні ділянки.*

Received date: 03.02.2020
Accepted date: 26.02.2020
Published date: 30.04.2020

1. Introduction

The state road management system of the country includes the effective management of its assets. The main asset is land plots on which transport facilities and the road maintenance sector are located. An important element of the land management process is mandatory procedures, including land valuation of the road sector [1].

Management decisions on these lands are carried out using a dynamic and internally interconnected process consisting of decision-making functions that can be influenced by various factors of both the external and internal environment [2, 3]. That is why the urgent task is to develop such a method that would make it possible to make effective informed management decisions regarding the valuation methods of roads.

So, *the object of research* is the land management process of the road sector.

The aim of research is to develop an algorithm for making effective management decisions on the valuation of land of the road sector.

2. Methods of research

The studies are based on developed authoring techniques described in [4–6]. The main hypothesis of the study is to apply a multistructure approach to the valuation of assets of the road sector [4, 5], including land. Each asset is considered as a complex object, is divided into simpler levels that contain components and elements that can already be evaluated separately.

Considering the hierarchical construction of a multistructure approach in asset valuation [5], in developing the algorithm for valuing land plots for management purposes, the AHP (Analytic Hierarchy Process) methodology by Thomas Saaty is used [6, 7] (Fig. 1).

It is customary to determine the value of a land plot depending on the type of ownership of the balance holder, namely: ownership of the land, rights to use or lease (according to [4]).

The cost of the right to use the land (V_l) is determined by the formula:

$$V_l = V_{RO} = \sum_{t=1}^{n} \frac{P_{mi}}{(1+R_c)^t}, \quad (1)$$

where V_{RO} – the value of the right of the owner of the land plot provided for rent or use, m. u.; P_{mi} – the actually accrued annual amount of land payment is defined as a fraction of the normative monetary value of the land plot, m. u.; R_c – capitalization rate for land; n – the forecasting period (in years).

ISSN 2664-9969

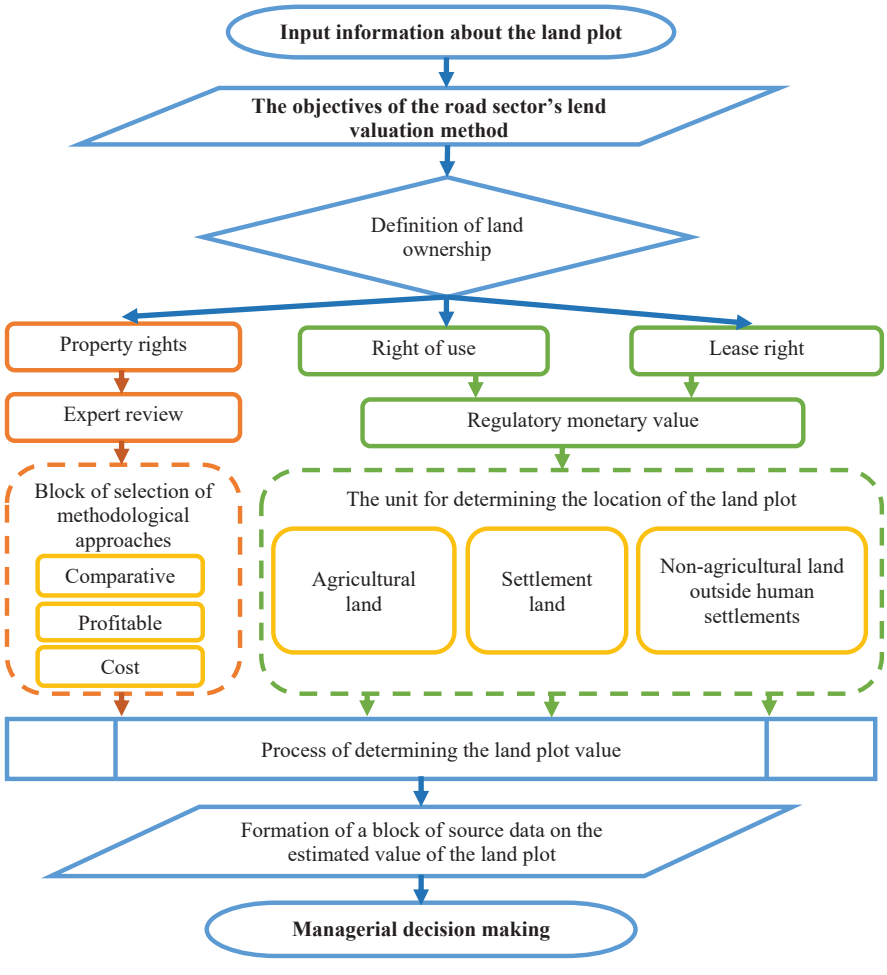

Fig. 1. The algorithm for the valuation of land plots for road management

The capitalization rate is determined by the formula:

$$R_c = B + \sum_{i=1}^{n} R_i, \quad (2)$$

where B – the risk-free interest rate; $\sum_{i=1}^{n} R_i$ – the amount of compensation of n risks.

The basic risk-free rate (B) should be adopted at the level of rates on the most reliable foreign currency deposits for legal entities of banks with monthly interest accrual.

Risk compensation includes:
– liquidity compensation;
– compensation of conditions for investments;
– compensation for the need for management;
– compensation for industry risks;
– other risks.

If the land plot is located outside the settlement, the value of the land plot (V_l) is determined as a normative monetary value according to [4], according to the formula:

$$V_l = V_N = S_A \cdot R_I \cdot K_P \cdot C_L \cdot C_U \cdot C_{MC} \cdot K_i, \quad (3)$$

where V_N – regulatory monetary value of the land, m. u.; S_A – the land area, taken according to the documentation on land management, m^2; R_I – rental income per 1 m^2 of area for the corresponding land category, which is determined by the rental income standards for the corresponding land category according to [4], m. u. in year; K_P – capitalization period, years; C_L – coefficient taking into account the location of land; C_U – coefficient taking into account the type of land use; C_{MC} – coefficient taking into account the belonging of the land plot to the lands of environmental, recreational, recreational, historical and cultural purposes; C_i – indexation coefficient of the normative monetary valuation of land.

If the land plot is located within a settlement, the normative monetary value of the lands of settlements is determined by the formula:

$$V_N = \frac{C \cdot P_m}{C_R} \cdot C_F \cdot C_L, \quad (4)$$

where V_N – normative monetary value per square meter of land (in m. u.); C – costs of development and arrangement of the territory per square meter (in m. u.); P_M – profit margin (6 %); C_R – capitalization rate (3 %); C_F – coefficient characterizing the functional use of the land (for residential and public buildings, for industry, transport, etc.); C_L – coefficient characterizing the location of the land, calculated by the formula:

$$C_L = C_{L1} \cdot C_{L2} \cdot C_{L3}, \quad (5)$$

where C_{L1} – coefficient characterizing regional factors, the location of the land plot; C_{L2} – coefficient characterizing zonal factors, the location of the land plot within settlements; C_{L3} – coefficient characterizing local factors, the location of the land plot according to territorial planning, engineering-geological, historical-cultural, natural-landscape, sanitary and hygienic conditions and the level of arrangement of the territory.

Indexation of the normative monetary valuation of land is carried out according to the formula:

$$K_I = I : 100, \quad (6)$$

where I – the consumer price index for the previous year.

If the consumer price index exceeds 115 percent, such an index is applied with a value of 115 according to [4].

Taking into account the indexation coefficient, the normative monetary value of the lands of settlements is determined by the formula:

$$V_{NI} = V_N \cdot K_I. \quad (7)$$

The cost of a single land plot (V_l) is defined as the product of a monetary value of one square meter of land and its area according to the formula:

$$V_l = V_N \cdot A_L, \quad (8)$$

where A_L – land area, m^2.

So, the algorithm includes the following sequence:

1. Database of incoming information about the land plot, which is the subject of management decisions, is being formed.

2. Goals of the valuation of the land plot of the road sector are determined [4, 5].

3. Legal component of the valuation is determined – the form of land ownership according to legal documents.

4. Type of monetary valuation is determined, which corresponds to the form of ownership determined at the previous stage.

5. According to a certain type of monetary valuation, a methodological approach or method of valuation is selected.

6. Valuation of the land is carried out according to the developed methodology [4].

7. Block of initial data on the estimated value of the land is formed.

8. Management decisions are taken with respect to the land plot, which are consistent with the objectives and correspond to the nature of the tasks of the functioning and development of the road sector [8–10].

3. Research results and discussion

According to the developed algorithm, it is tested on a real object – a land plot under a category II highway with a length of 1.127 m, which is located within the settlement.

According to the algorithm and [4], the procedure for conducting a normative monetary valuation of a land plot located under a highway is as follows:

1. The determination of the costs of development and arrangement of the territory.

According to [4], the base value of 1 m^2 of land in this example is 49.21 monetary units.

2. Determination of the ownership of the object of valuation of a particular economic and planning zone of the village. No zoning of the territory was carried out in this locality.

3. Determination of functional, regional, zonal and local factors (according to [4]):

$$C_{L1}=0.9,\ C_{L2}=1,\ C_{L3}=1.$$

4. The determination of the coefficients C_L and C_F:

$$C_L=0.9\cdot1\cdot1=0.9.$$

This land plot belongs to the category of land transport. So, $C_F=1$.

5. The year of the last regulatory monetary valuation of the settlement – 2013.

6. The indexation of the monetary valuation of land (according to official sources), Table 1.

Table 1

Land valuation indexation

Indexing year	The indexation coefficient of the normative monetary valuation of land (K_i)
2014	1.0
2015	1.0
2016	1.0
2017	1.249
2018	1.433
2019	1.06
Reduced indexation coefficient K_i	1.9

7. The normative monetary value per square meter of land is determined by the formula from [4]:

$$V_N=\frac{49.21\cdot0.06}{0.03}\cdot1\cdot0.9=88.58 \text{ m. u.}$$

8. The normative monetary value of the lands of settlements, taking into account the indexation coefficient, is determined by the formula from [4]:

$$V_N=88.58\cdot1.9=168.30 \text{ m. u.}$$

9. The cost of a separate land plot (V_l) on which a category II highway of 1.127 m is built is determined by the formula from [4]:

$$V_l=168.30\cdot90160=15173928{,}00 \text{ m. u.}$$

The developed algorithm allows to accurately determine the reasonable cost of the land plot of the road sector. This approach allows to optimize the process of valuation and management of road assets, which is especially important within limited financial resources. The estimated error of the algorithm is about 3 % [4, 6, 7].

4. Conclusions

The issues of types of valuation of land of the road sector, depending on the input information and goals of managing road assets, are considered. A method for the valuation of land plots of the road sector for management purposes is developed. A feature of the algorithm is the application of a multi-structure approach in combination with the AHP methodology by Thomas Saaty. Land valuation by the given sequence is an important aspect, the main component of the valuation of the value of the asset of the road sector located on it, which further reflects the state of the transport network as a whole. This information is the basis for asset management and the supervision of the impact of various financial capital investment strategies in the road sector.

References

1. Özcan, İ. Ç. (2018). The privatization of roads: An overview of the Turkish case. *Case Studies on Transport Policy, 6 (4),* 529–536. doi: http://doi.org/10.1016/j.cstp.2018.07.001
2. Osman, M. A. M. (2017). Impact of the Dimensions of Strategic Information Quality as Mediator Variable in the Relationship between Effectiveness of Strategic Decisions and Achieving Strategic Objectives: Case Study Cement Factory, Bisha, Saudi Arabia. *Singaporean Journal of Business Economics and Management Studies, 5 (10),* 16–27. doi: http://doi.org/10.12816/0037570
3. Lapidus, A., Makarov, A. (2016). Fuzzy sets on step of planning of experiment for organization and management of construction processes. *MATEC Web of Conferences, 86,* 05003. doi: http://doi.org/10.1051/matecconf/20168605003
4. *MR D 1.2-37641918-884:2017 Metodychni rekomendatsii z provedennia vartisnoi otsinky avtomobilnykh dorih i sporud na nykh* (2017). Kyiv, 92.
5. Slavinska, O., Savenko, V., Kharchenko, A., Bubela, A. (2017). Development of a mathematical model of eevaluation of road-and-transport assets as a component of information-and-management system. *Eastern-European Journal of Enterprise Technologies, 6 (4 (90)),* 45–57. doi: http://doi.org/10.15587/1729-4061.2017.118798

ISSN 2664-9969

6. Slavinska, O., Stozhka, V., Kharchenko, A., Bubela, A., Kvatadze, A. (2019). Development of a model of the weight of motor roads parameters as part of the information and management system of monetary evaluation. *Eastern-European Journal of Enterprise Technologies, 1 (3 (97))*, 46–59. doi: http://doi.org/10.15587/1729-4061.2019.156519
7. Tikhomirova, A. N., Sidorenko, E. V. (2012). Modifikatsiia metoda analiza ierarkhiy T. Saati dlia rascheta vesov kriteriev pri otsenke innovatsionnykh proektov. *Sovremennye problemy nauki i obrazovaniia, 2*. Available at: http://www.science-education.ru/ru/article/view?id=6009
8. McPherson, K., Bennett, C. R. (2005). *Success Factors for Road Management Systems*. Washington: The World Bank. Available at: https://www.scribd.com/document/43279399/Success-Factors-For-Road-Management-Systems
9. Hordijk, A. C. (2012). Real Estate Appraisal and International Valuation Standards. *XLI Incontro di Studio del Ce.S.E.T.* Tias-Nimbas Business School, Tilburg University, 397–401.
10. McNeil, S. (2000). *Asset Management and Asset Valuation: The Implication of the Government Accounting Standards Bureau (GASB)*. Standards for Reporting Capital Assets. Midcontinent Transportation Symposium. Minnesota, 34–37.

Slavinska Olena, *Doctor of Technical Sciences, Professor, Department of Transport Construction and Property Management, National Transport University, Kyiv, Ukraine, e-mail: elenaslavin9@gmail.com, ORCID: http://orcid.org/0000-0002-9709-0078*

Kharchenko Anna, *PhD, Associate Professor, Department of Transport Construction and Property Management, National Transport University, Kyiv, Ukraine, e-mail: anna-x3@ukr.net, ORCID: http://orcid.org/0000-0001-8166-6389*

Bubela Andrey, *PhD, Associate Professor, Department of Transport Construction and Property Management, National Transport University, Kyiv, Ukraine, e-mail: bubelaandrey@ukr.net, ORCID: http://orcid.org/0000-0002-5619-003X*

Chechuha Oleksandr, *PhD, Associate Professor, Department of Transport Construction and Property Management, National Transport University, Kyiv, Ukraine, e-mail: as000@i.ua, ORCID: http://orcid.org/0000-0003-1643-6354*