GEODESY AND CARTOGRAPHY
Vol. 68, No. 2, 2019, pp. 321–328

DOI: https://doi.org/10.24425/gac.2019.128467

Short communication

The method for assessing the urban land investment attractiveness

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Received: 3 August 2019 / Accepted: 9 September 2019

Abstract: In modern conditions of urban development, there is a need to improve the technology for determining the investment attractiveness of urban lands by developing a method and models for assessing its impact, which will be based on the construction of a two-level system of indicators, which will determine the integral investment criterion and develop guidelines for improving the investment attractiveness of urban lands. As a result of the research, the value of the integral indicator of urban land investment attractiveness was determined, which allowed to apply it in the system of normative monetary valuation of urban land and to develop methodological recommendations for improving the efficiency of its investment attractiveness assessment. A method for assessing the investment attractiveness of urban land, as the main element of technology, based on the determination of indicators for assessing the integral criterion for the development of guidelines for improving the urban land investment attractiveness is developed. By the value of the integral criterion, the integral indicators of the potential investment attractiveness of urban lands are determined, considering the changes in the normative monetary value of the lands of settlements and the level of investment attractiveness of the regional centers of Ukraine is determined.

Keywords: investment attractiveness, integral assessment, urban land, normative monetary valuation, investment criterion

1. Introduction

In modern conditions of urban development, a rethinking of approaches to the implementation of technologies for determining and evaluating the investment attractiveness of land needs attention considering the following characteristics:

– functional-planning,

– territorial,
– engineering support and improvement of territories,
– ecological and historical-cultural.

Therefore, it is important to analyze the existing theoretical provisions for determining and developing a method of assessing the investment attractiveness of urban land. The investment attractiveness of land is an important field of research. In the works of foreign and domestic authors, much attention is paid to determining the directions of rational use of land resources by attracting investments. In particular, the presented issues are considered in (Kravchuk, 2013; Larsson, 1991; Mamonov, 2016a,b; Palekha, 2010; Sallivan, 2002; Bober et al., 2016a,b; Gasiorowski and Bielecka, 2014; Maleta and Mościcka, 2018; European Business Association, 2016). Danylyshyn (2006) and Novakovskii (2009) argue that the investment potential of the territory is characterized by a set of objective conditions for investment, which can be measured and expressed in quantitative indicators. According to the scientists (Drozdovsky, 2004; Calka and Bielecka, 2016; Freeman et al., 2010; Goodijk, 2003; Ukrainian business magazine "Expert", 2014), the distribution of regions according to the integral rating of investment attractiveness gives the investor the basis for previous reflections on the choice of land to multiply their capital. At the same time, the most attractive are lands with high investment potential and low-risk factor.

Further development of cities and regions and the country as a whole depends on the creation of a favorable investment climate in the land sector of cities. The urban development processes are primarily determined by the volume and growth rate of investments in their lands, which change their structure and qualitative characteristics. But, in most cases, the modern system of normative monetary valuation is not taking to account the complex of factors that directly form the investment attractiveness of urban lands. The presented feature is determined by the complexity of applying modern approaches and tools, the lack of information support and the lack of an integrated indicator for assessing the investment attractiveness of urban lands. Therefore, under these conditions, there is a need to improve the technology for determining the investment attractiveness of urban lands by developing a method and models for assessing its impact, which will be based on the construction of a two-level system of indicators, which will determine the integral investment indicator and develop methodological recommendations to increase the investment attractiveness of urban lands.

2. Materials and methods

Development of method and models of integral assessment of investment attractiveness of urban lands is carried out on the basis of stages, which are presented in Figure 1 (Radzinska, 2018). Considering the directions within the framework of the proposed method, it should be pointed out that the creation of information support for assessing the influence of factors on the formation of investment attractiveness of urban lands is carried out in accordance with (Geary, 1954; Kukushkin, 2015; Lesnikova, 2004; Mamonov et al., 2016; Papp, 2006; Sivelkin and Kuznetsova, 2013) and the technical features of urban land use.

1. Information support for the integrated assessment of urban land investment attractiveness

2. Definition and characterization of factors affecting the formation of urban land investment attractiveness

3. Building a multi-level system of indicators affecting the formation of urban land investment attractiveness based on a hierarchical classification method $\langle I_f, I_p, I_{ing}, I_e \rangle$

4. Determination of the second level indicators based on the minimum values of local coefficients analytical data of land investment attractiveness

5. Assessment of the second level indicators by summarizing each group of indicators based on local models:

$$I_f^2 = \sqrt[12]{I_{f1}^2 * I_{f2}^2 * I_{f3}^2 * I_{f4}^2 * I_{f5}^2 * I_{f6}^2 * I_{f7}^2 * I_{f8}^2 * I_{f9}^2 * I_{f10}^2 * I_{f11}^2 * I_{f12}^2}; \quad I_p^2 = \sqrt[6]{I_{p1}^2 * I_{p2}^2 * I_{p3}^2 * I_{p4}^2 * I_{p5}^2 * I_{p6}^2};$$

$$I_{ing}^2 = \sqrt[6]{I_{ing1}^2 * I_{ing2}^2 * I_{ing3}^2 * I_{ing4}^2 * I_{ing5}^2 * I_{ing6}^2}; \quad I_e^2 = \sqrt[13]{I_{e1}^2 * I_{e2}^2 * I_{e3}^2 * I_{e4}^2 * I_{e5}^2 * I_{e6}^2 * I_{e7}^2 * I_{e8}^2 * I_{e9}^2 * I_{e10}^2 * I_{e11}^2 * I_{e12}^2 * I_{e13}^2}$$

6. Assessment of the first level indicators using local models considering the influence of investment factors groups and the level of interaction between them:
$I_f = \sum_{i=n}^{1} K_{fi} * I_{fi}$; $I_p = \sum_{i=n}^{1} K_{pi} * I_{pi}$; $I_{ing} = \sum_{i=n}^{1} K_{ingi} * I_{ingi}$; $I_e = \sum_{i=n}^{1} K_{ei} * I_{ei}$, where K_{fi}, K_{pi}, K_{ingi}, K_{ei} - are the weight coefficients characterizing the influence of the i-th indicators of the second level on the indicators of the first level

7. Estimation of weight coefficients by the method of hierarchy analysis:
$K_{ii} = \frac{I_{vi}}{\sum_{i=n}^{1} I_{vi}}$, where
I_{vi} - are the eigenvector components, which are determined by the constructed matrices of mutual influence of local models indicators

8. Development of a model for integrated assessment and determination of the integral criterion of urban land investment attractiveness:
$I_i = I_f + I_p + I_{ing} + I_e$,
where I_f, I_p, I_{ing}, I_e– are the first level integral indicators of urban land investment

9. Development of guidelines for improving the urban land investment attractiveness

Fig. 1. The scheme and the main elements of the method of integrated assessment of urban land investment attractiveness

The determination and characterization of factors affecting the formation of investment attractiveness of urban lands and the construction of a multi-level system of indicators are carried out on the basis of the study presented in (Radzinska, 2018). The results of assessing the investment attractiveness of urban lands are carried out according to an integrated indicator, the definition of which is presented in the model (Eq. (1))

$$I_i = I_f^1 + I_p^1 + I_{ing}^1 + I_e^1 \tag{1}$$

where $I_f^1, I_p^1, I_{ing}^1, I_e^1$ – are the first level integral indicators of investment attractiveness of urban land.

To simulate the influence of factors on the formation of investment attractiveness of urban lands, local second-level indicators are determined on the basis of the minimum (accepted by the author as the least attractive investment conditions) values of analytical data of local coefficients of investment attractiveness of urban lands. The assessment of the second level indicators of investment attractiveness of urban lands is carried out by summarizing each group of indicators based on local models (Table 1).

Table 1. The local models for determining the second level integral indicators of investment attractiveness of urban land

Integral indicator	The local model
Functional planning indicators $\left(I_f^2\right)$	$I_f^2 = \sqrt[12]{I_{f1}^2 \cdot I_{f2}^2 \cdot I_{f3}^2 \cdot I_{f4}^2 \cdot I_{f5}^2 \cdot I_{f6}^2 \cdot I_{f7}^2 \cdot I_{f8}^2 \cdot I_{f9}^2 \cdot I_{f10}^2 \cdot I_{f11}^2 \cdot I_{f12}^2}$
Territorial indicators $\left(I_p^2\right)$	$I_p^2 = \sqrt[6]{I_{p1}^2 \cdot I_{p2}^2 \cdot I_{p3}^2 \cdot I_{p4}^2 \cdot I_{p5}^2 \cdot I_{p6}^2}$
Indicators of engineering support and land improvement $\left(I_{eng}^2\right)$	$I_{ing}^2 = \sqrt[6]{I_{eng1}^2 \cdot I_{eng2}^2 \cdot I_{eng3}^2 \cdot I_{eng4}^2 \cdot I_{eng5}^2 \cdot I_{eng6}^2}$
Indicators of the environmental, ecology and historical and cultural component $\left(I_e^2\right)$	$I_e^2 = \sqrt[13]{I_{e1}^2 \cdot I_{e2}^2 \cdot I_{e3}^2 \cdot I_{e4}^2 \cdot I_{e5}^2 \cdot I_{e6}^2 \cdot I_{e7}^2 \cdot I_{e8}^2 \cdot I_{e9}^2 \cdot I_{e10}^2 \cdot I_{e11}^2 \cdot I_{e12}^2 \cdot I_{e13}^2}$

Assessment of the first level indicators of investment attractiveness of urban lands is determined using local models, which consider the influence of investment factors groups and the level of interaction between them (Table 2). The weights used in local models to determine the first level integral indicators of investment attractiveness of urban lands are determined by applying the hierarchy analysis method. This method is based on the use of a basic scale.

Based on the proposed models for assessing investment attractiveness factors, a scheme and the main elements of the method for assessing the influence of these factors on the formation of investment attractiveness of urban lands have been developed (Fig. 1). The presented method is a sequence of stages, including the development of information support for the integrated assessment of the investment attractiveness of urban lands, the construction of a multi-level system of indicators based on the

Table 2. The local models for determining the first level integral indicators of investment attractiveness of urban lands

Integral indicator	The local model
Functional planning indicators $\left(I_f^1\right)$	$I_f^1 = I_f^2 \cdot K_f^1$ where K_f^1 – is the weight characterizing the influence of functional planning indicators on the integral criterion of investment attractiveness
Territorial indicators $\left(I_p^1\right)$	$I_p^1 = I_p^2 \cdot K_p^1$ where K_p^1 – is the weight characterizing the influence of territorial indicators on the integral criterion of investment attractiveness
Indicators of engineering support and land improvement $\left(I_{eng}^1\right)$	$I_{ing}^1 = I_{eng}^2 \cdot K_{eng}^1$, where K_{eng}^1 – is the weight characterizing the influence of indicators of engineering support and land improvement on the integral criterion of investment attractiveness
Indicators of the environmental, ecology, historical and cultural component $\left(I_e^1\right)$	$I_e^1 = I_e^2 \cdot K_e^1$ where K_e^1 – is the weight characterizing the influence of indicators of the environmental, ecology, historical and cultural component on the integral criterion of investment attractiveness

hierarchical classification method, the development of local mathematical models for assessing level indicators and the model of the integral criterion of investment attractiveness of urban lands.

3. Results

Thus, as a result of the study, a method for the integral assessment of the investment attractiveness of urban lands, as an element of technology, based on the application of the analytical method, the hierarchy analysis method and the hierarchical classification method is proposed. This made it possible to determine the integral criterion of investment attractiveness and create an information basis for developing methodological recommendations for its improvement, considering the regulatory legal, functional planning and territorial indicators, an indicator of engineering support and land improvement, as well as their environmental, historical and cultural component.

The assessment results of the integral indicator of investment attractiveness of urban land are presented in Table 3.

Table 3. The results of the assessment of the first level integral indicators of investment attractiveness of urban lands, in relative units

Integral indicator	The value of the integral indicator
Functional planning indicators $\left(I_f^1\right)$	0.231
Territorial indicators $\left(I_p^1\right)$	0.222
Indicators of engineering support and land improvement $\left(I_{eng}^1\right)$	0.150
Indicators of the environmental, ecology, historical and cultural component $\left(I_e^1\right)$	0.288

As a result, the integral criterion of investment attractiveness of urban lands was determined (0.891), the value of which indicates a high level of influence of the studied factors on its formation and allows to apply it in the system of normative monetary valuation of urban land and develop guidelines for improving the effectiveness of this assessment.

4. Conclusions

By the value of the integral criterion, the integral indicators of the potential investment attractiveness of urban lands are determined, considering the changes in the normative monetary value of the lands of settlements and the level of investment attractiveness of the regional centers of Ukraine is determined. A method for assessing the investment attractiveness of urban land, as the main element of technology, based on the determination of indicators for assessing the integral criterion for the development of guidelines for improving the urban land investment attractiveness is developed. The indicated values of the integral criterion of investment attractiveness of urban lands made it possible to apply it in the system of normative monetary valuation and to determine the potential investment attractiveness of urban lands. Based on the integral criterion value, the integral indicators of the potential investment attractiveness of urban lands are determined considering the changes in the normative monetary value of the lands of the settlements. The level of investment attractiveness of regional centers of Ukraine has been determined. At the same time, the value of integrated indicators of urban lands potential investment attractiveness, considering the changes in the normative monetary valuation of the lands of the settlements, is in the range of 0.9–3.5 relative units, which generally shows low rates of implementation of the normative monetary valuation of settlements in Ukraine and the neglect of the proposed groups factors, reduces the assessment effectiveness of the investment attractiveness of the lands of the settlements.

Acknowledgments

The study has not external funds.

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