Research paper

City lands investment attractiveness calculation

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Abstract: Improving the technology for determining the investment attractiveness of urban land requires the development and implementation of an integrated assessment method. In this context, the formation of a system of indicators used for the integral assessment is very important. Based on the two-level system of factors proposed in the article, which influence the formation of investment attractiveness of urban land and using a hierarchical classification method, an appropriate system of indicators is constructed. The transition from factors to indicators is ensured by the established causal dependence, which characterizes the causal relationships between factors and functional-planning, territorial indicators, indicators of engineering and territory improvement, indicators of ecology, historical and cultural significance. In article it is proposed to consider the information support as a set of functional-planning, territorial, engineering support and improvement of the territory, environment, ecology, historical and cultural indicators, which are formed on the basis of normative legal acts, systematization of theoretical and methodological provisions, considering technological features and factors, which affect the investment attractiveness of land. Considering the existing directions for the implementation of technology for assessing the investment attractiveness of urban land, the economic, spatial, complex, multifactorial, rating approaches and approach based on the tools and results of mathematical modelling, considering technical, environmental, social and economic factors, which influence the investment attractiveness of urban land have been proposed.

1. Introduction

In recent years, the relevance of the issue of determining the investment attractiveness of cities and towns lands of the country has significantly increased. In modern conditions,

the assessment of investment attractiveness becomes a serious factor of influence, when there are a number of restrictions on the possibility of the traditional methods influence on the efficiency improvement of cities land use. Whereas, this assessment can significantly regulate the processes of economic and urban development of cities. According to V. Kravchuk, in terms of investment attractiveness, modern approaches to the city land use are not optimal. Most of the central lands of cities are occupied by industrial enterprises, objects of protection, energy and manor buildings. Such land use is not rational and investment is not justified (Kravchuk, 2013; Sallivan, 2002). 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.

Nowadays, there are several approaches to determining the investment attractiveness of urban land:
– size comparison of the real and normative investments in the land;
– calculation of a simple index of investment attractiveness in relation to real and regulatory capital investments in the land;
– calculation of the extended index of investment attractiveness of urban land, which is defined as the geometric average of investment attractiveness indices and investment volume.

In Ukrainian business journal "Expert" (2014) is stated that the distribution of regions according to the integral rating of investment attractiveness gives the investor the basis for preliminary 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. Another ratio indicator of risk and potential is the personal contributions of the population: the higher the economic potential of the city and the lower the investment risk, the greater the absolute and per capita contributions of the population. This shows that high investment risk is felt by the population, and people are afraid of making deposits in their own investment unattractive regions. The share of accumulated capital investments and foreign investment shows a downward trend as the investment potential of urban land decreases.

In the Ukrainian business journal "Expert" (2014) the scientists emphasize that the realization of the investment potential of land in cities involves two main algorithms of action. The first point is that the targeted influence of the investor on the key properties of the investment object allows this investor to gain control over the reliability and efficiency of their own investments. The process of acquiring control over the effectiveness of investments requires, as a condition, that the main activity of the investee be transparent. This allows the investor to evaluate the possibility of investing his funds. If such a decision is made, before investing in the project, the investor must first make sure that he can control the creation and implementation of the project strategy.

Further, in the process of creating and adjusting mechanisms for monitoring, which financial policy is subject to the adopted strategy of activity, the investor forms the purpose of the resources allocation, ensuring the transparency of financial activities, and thus establishing the necessary control over the reliability of investments. And, finally, by purposefully influencing the placement of managers in accordance with their man-

agerial abilities, the investor increases the reliability of the management system, thus establishing sufficient control over the reliability of his own investments. If at one of the steps the investor does not feel his ability to control the invested funds, he will not direct new investments. If the act of investment has taken place, then a system of purposeful allocation of resources and reliability of the management system is built up, which increases the investment attractiveness of the object not only for himself but also for other investors.

The meaning of the second algorithm is that the key properties of the investment attractiveness of the object are created on the initiative of the territorial authorities. In this case, at the stage of the formation of mechanisms, which ensure the transparency of activities, the governing bodies regulate the access of the investor, both to the creation of these mechanisms, and to the participation in the control of their operation, and, the wider is the access, the higher is the investment attractiveness of the object for the investor. When the mechanisms are formed and adjusted, the management of the investment attractiveness of the object is reduced to guarantees of attracting the investor to make strategic decisions and form the financial policy of the object. The aim of the study is to determine the value of the integral criterion of city lands investment attractiveness, its application in the system of city lands normative monetary valuation and to develop methodological recommendations for increasing the efficiency of city lands investment attractiveness callculation.

2. Materials and methods

The assessment and selection of urban lands for various purposes and directions of their use depends on the influence of a number of criteria, which may affect the development and planning of the functional sphere of the city. These are the following criteria: the planning structure of the city, the provision of links between the constituent parts of the city, functional comfort or land security, urban development indicators, spatial and environmental conditions. All of these factors directly affect the use of land in the city and form the direction of its development. Consequently, the investment attractiveness of urban lands depends on many factors. At the same time, it can in some way characterize the land values and have a direct impact on the planning of development, economical use and other sectors of the local level (Larsson, 1991; Danylyshyn, 2006).

The practice of distributing and using the land of the city is widely used in the world. For each plot of land for its functional purpose, a list of usage types, which can exist in any part of the city or a separate area is compiled. According to the normative base specified in DBN 360-92** "Town planning. Planning and development of urban and rural settlements" and the master plan of urban land are divided according to their territorial planning purpose (Danylyshyn, 2006; Palekha, 2010).

Thus, according to this approach, each land plot of the city must meet the requirements, considering the features of the structural and planning characteristics of the city. The author's definition of investment attractiveness of the land of cities is proposed, which includes a set of technological features and factors, the interaction of which is

aimed at increasing the value of land and raising the interest of investors, landowners, land users, public authorities and public organizations.

In existing studies, there are different approaches to developing technology for assessing the investment attractiveness of land in cities. In particular, the aim of research by many scientists (Mamonov et al., 2016; Mamonov, 2016a,b; Anselin, 1988; Blair and Fottler, 1990; Cliff and Ord, 1973; Freeman et al., 2010; Geary, 1954; Goodijk, 2003) is to substantiate the need to assess the investment attractiveness of city lands for creating regional development programs, information and economic justification for investments at the regional level. Thus, it is necessary to analyze the principles of existing land valuations, to identify their advantages and disadvantages, and to identify the factors, which influence the assessment of the investment attractiveness of land in cities.

Today, there are several types of assessments, the object of which the land is, but which consider it in different aspects. In Ukraine, according to the Land Code (The Land Code of Ukraine, 2002), two types of land monetary valuation coexist regulatory assessment, which is carried out within settlement pricing based on ideas about the nature of optimal use of land, expert assessment based on market principles. A special place is occupied by economic evaluation, which determines the profitability of land. The use of a particular assessment in the economic regulation of land relations is regulated by current legislation and is based on normative and methodological developments (European Business Association, 2016). Thus, the regulatory assessment of land serves as the basis for taxation, and an expert monetary assessment of land at the conclusion of civil law transactions. An economic assessment serves as the basis for the implementation of normative monetary valuation of land.

The analysis of existing land valuation technologies makes it possible to draw the following conclusions. An economic assessment examines a land plot in terms of its profitability, that is, in the process of evaluation, the economic effect of using different quality land is determined. Yield is used as an initial indicator of the economic assessment of land. Therefore, the economic assessment is not able to present the investment attractiveness of urban land. Moreover, the last time the economic evaluation of most cities in Ukraine was conducted more than 10 years ago, which does not allow to fully use its results at present.

Normative monetary valuation is based on the data of economic evaluation, considers the land plot separately from the objects of the real estate located on it, operates with standard rental income, considers the land improvements, which are carried out outside the land plot, and is focused on large areas. According to experts (Anselin, 1988; Blair and Fottler, 1990; Cliff and Ord, 1973; Freeman et al., 2010; Geary, 1954; Goodijk, 2003), the disadvantages of this type of assessment is that it does not consider the current market conditions and economic situation, social and demographic factors and is not perspective oriented.

The expert monetary assessment considers the land plot in unity with other objects of the real estate, takes into account land improvements, which are carried out both outside and within the boundaries of the land, is focused on individual features, including the specific circumstances of the transaction, operates with a real possible rental income,

takes into account the current market and economic situation. The value obtained as a result of the expert evaluation is derived from the profitability of the activity, which is localized within the boundaries of the land plot. This type of evaluation has a market character.

Based on the analysis of literary sources (European Business Association, 2016; Lesnikova, 2004; European Business Association, 2016; Calka and Bielecka, 2016; Bober et.al., 2016a,b; Gasiorowski and Bielecka, 2014; Maleta and Mościcka, 2018) and personal conclusions, it can be said that in modern conditions the technology of expert evaluation focuses on determining the value of land as an object of investment and property – a specific real estate property, in respect of which a number of rights are being formed related to its possession, use, and disposal. The peculiarity of the expert assessment is its location and decentralization, that is, at the present time it only to a certain extent satisfies the interests of the land plots of Ukrainian cities, as it makes it impossible to evaluate large areas of the city.

On the basis of the analysis, it is determined that each of the presented technological aspects does not correspond to the task of assessing the land of cities, considering the complex of functional-planning, territorial, engineering support and improvement of territories as like as ecological, historical and cultural factors. Therefore, it is proposed to apply the technology of integrated assessment of investment attractiveness of the land of cities by modelling the influence of the presented factors. The investment attractiveness of land can be estimated by numerous factors and criteria. A decision on how to invest money better should be taken separately in each specific case, but investment planning should be based on a spatial analysis of lands, which are classified according to their degree of investment attractiveness. Concepts such as the conjuncture of the relevant market segment, the infrastructure of the district, the location and modern consumer preferences play a significant role and only an analysis of all the components will allow choosing the investment option.

According to (Sivelkin and Kuznetsova, 2013; Drozdovsky, 2004), the assessment of investment attractiveness must be specific and rapidly change both in time and space, depending on many conditions and factors: the general economic situation, the level of income and solvency of investors, the legal environment, demand fluctuations and offers, personal motives and personal interests of a particular buyer and seller who are closely related and affect each other. In order to ensure these conditions, it is necessary to create a completely functional system of geographically bound information on the state of the land fund, which will be collected and updated in the course of monitoring the investment attractiveness of land. In practice, there are numerous approaches for determining the investment attractiveness of land in cities. On the basis of the conducted analysis (Drozdovsky, 2004; Papp, 2006), it is possible to identify the main approaches and formulate the phases of their implementation:

1. Selection of criteria according to experts, which form the conditions for creating investment attractiveness and determine its level.
2. Determination of expert assessment and the influence of each of the factors, considering their mutual influence by means of determination of their weight coefficients.

3. Determination of indicators, which according to expert assessment are the most influential and most affect the investment attractiveness of urban land. These indicators can be equal in value and differ significantly. This determines the degree of influence of each of the indicators.

4. According to the chosen methodology, the calculation of individual indicators is carried out.

5. Identified individual results are integrated into groups. If necessary, the degree of their influence is found by determining weight coefficients.

6. The obtained integral result of each indicator is considered its corresponding estimate.

7. The determined results, considering the weighting coefficients, are integrated into a single rank, which characterizes the level of investment attractiveness of the land plot of the city.

The rank value may be of any kind, but it must correspond to a scale, which decodes the value and allows to draw the conclusions. With this method of evaluation, the quality of each criterion is not analyzed, but in general, the level of investment attractiveness of the cities land is estimated (Kukushkin, 2015).

Andreev (2013) highlights the factors, which negatively affect the decision of investors to form and use funds in the field of land relations in cities. These include: political instability; lack of guarantees from the state; insufficient investor protection; imperfect legislative base; the growth of inflation; reduction of privileges for investors; the undeveloped banking system, etc.

3. Results

Improving the technology for determining the investment attractiveness of urban land requires the development and implementation of an integrated assessment method. In this context, the formation of a system of indicators used for the integral assessment is very important. Based on the proposed two-level system of factors, which influence the formation of investment attractiveness of urban land and using a hierarchical classification method, an appropriate system of indicators is constructed (Kukushkin, 2015).

The transition from factors to indicators is ensured by the established causal dependence (Eq. (1)), which characterizes the causal relationships between factors and functional-planning, territorial indicators, indicators of engineering and territory improvement, indicators of ecology, historical and cultural significance.

$$F = \left\{ (F_1 \to I_f), \, (F_2 \to I_p), \, (F_3 \to I_{ing}), \, (F_4 \to I_b) \right\}, \tag{1}$$

where F_1, F_2, F_3, F_4 are groups of factors, which are determined by functional-planning, territorial indicators, indicators of engineering and territory improvement, indicators of ecology, historical and cultural significance, $\to$ is the causal dependence characterizing causal relationships between factors and indicators.

The transition from factors to indicators at the second level was provided using Eq. (2)–(5), which takes into account their number for each group at the second level

of indicators:

$$F_1 = \{I_{fk}\}, \quad k = \overline{1.12}, \tag{2}$$

where I_{fk} are the functional and planning indicators, k is the number of group indicators.

$$F_2 = \{I_{pj}\}, \quad j = \overline{1.6}, \tag{3}$$

where I_{pj} are the territorial indicators, j is the number of group indicators.

$$F_3 = \{I_{ingb}\}, \quad b = \overline{1.6}, \tag{4}$$

where I_{ingb} are the indicators of engineering and territory improvement, b is the number of group indicators.

$$F_4 = \{I_{by}\}, \quad y = \overline{1.13}, \tag{5}$$

where I_{ey} are the indicators of ecology and historical and cultural significance, y is the number of group indicators.

Elements of a two-level system of indicators, which affect the formation of investment attractiveness of urban land are presented in Table 1. In the two-level system of indicators, the author made their justification on normative provision as follows:

– functional and planning indicators (I_f) are determined on the basis of DBN 360-92** "Town planning. Planning and development of urban and rural settlements"; DBN B.2.2-5: 2011 "Improvement of territories"; DBN V.2.1-10-2009 "Bases and foundations of buildings";

– territorial indicators (I_p) – are determined on the basis of data from the State Statistics Service of Ukraine; data from the NAS of Ukraine; data from the Institute for Economic Research and Policy Consulting;

– indicators of engineering and territory improvement (I_{ing}) are determined on the basis of DBN V.2.5-39: 2008. "Extranets and structures"; DBN 360-92 ** "Town planning. Planning and development of urban and rural settlements";

– indicators of ecology and historical and cultural significance (I_e) are determined on the basis of DBN B.2.2-5: 2011 "Improvement of territories"; DBN V.2.1-10-2009 "Bases and foundations of buildings".

Summarizing the above, a scheme of a two-level system of indicators, which form the investment attractiveness of the land of cities (see Figure 1) is developed (Kukushkin, 2015). Thus, according to the determined levels of factors influencing the investment attractiveness of the land of cities, local indicators are proposed, which form an integral investment criterion. As a result of technology development, four groups of indicators of the first level are defined, which are formed by indicators of the second level, which, in turn, form a two-level system and an information basis for assessing the influence of the relevant factors on the formation of investment attractiveness of the land of cities.

The proposed system of indicators makes it possible to create integral and local models of estimation, as well as to determine the influence of each of the local factors on the integral criterion of investment attractiveness of the land of cities considering the connections between the groups of factors.

Table 1. Elements of a two-level system of indicators, which influence the formation of investment attractiveness of the land of cities (developed by the author) (Kukushkin, 2015)

| First level indicators	Second level indicators	Normative substantiation of the indicator
1. Functional and planning indicators (I_f)	1.1. Accessibility of community centres (I_{f1}); 1.2. Areas of highways of increased city-forming significance (I_{f2}); 1.3. Passenger transport accessibility zones (I_{f3}); 1.4. Areas of accessibility for resort and park complexes places of interest and entertainment (I_{f4}); 1.5. Areas adjacent to a railroad branch or the location of the railroad (I_{f5}); 1.6. Relief of the territory (I_{f6}); 1.7. Bearing capacity of soils (I_{f7}); 1.8. Groundwater bedding (I_{f8}); 1.9. Floodwater flooding (I_{f9}); 1.10. Waterlogging of the territory (I_{f10}); 1.11. Geological characteristic of the area (I_{f11}); 1.12. Structural features of soils (artificiality) (I_{f12}).	DBN 360-92 ** Town planning. Planning and development of urban and rural settlements; DBN B.2.2-5: 2011 Improvement of territories; DBN V.2.1-10-2009 Bases and foundations of buildings
2. Territorial indicators (I_p)	2.1. Geographic indicators (I_{p1}); 2.2. Social indicators (I_{p2}); 2.3. Economic indicators (I_{p3}); 2.4. Information indicators (I_{p4}); 2.5. Administrative indicators (I_{p5}); 2.6. Climatic and spatial indicators (I_{p6}).	State Statistics Service of Ukraine; data of NAS of Ukraine; data from the Institute for Economic Research and Policy Consulting
3. Indicators of engineering and territory improvement (I_{ing})	3.1. The presence of a hard coating (I_{ing1}); 3.2. Availability of centralized water supply (I_{ing2}); 3.3. Presence of sewerage (I_{ing3}); 3.4. Availability of heating networks (I_{ing4}); 3.5. Availability of gas supply (I_{ing5}); 3.6. Infrastructure support of the territory (I_{ing6}).	DBN V.2.5-39 2008. Extranets and structures; DBN 360-92 ** Town planning. Planning and development of urban and rural settlements;
4. Indicators of ecology and historical and cultural significance (I_e)	4.1. Zones of the protected area (I_{e1}); 4.2. Development control zones (I_{e2}); 4.3. Zones of protection of the historical landscape (I_{e3}); 4.4. Lands of protection of monuments (I_{e4}); 4.5. Lands of the park area (I_{e5}); 4.6. Recreational areas (I_{e6}); 4.7. Recreational areas (resort areas) (I_{e7}); 4.8. Sanitary protection zones (I_{e8}); 4.9. Lands of water protection zones (I_{e9}); 4.10. Lands with limited building on the degree of air pollution (I_{e10}); 4.11. Lands with limited building on the voltage level of the electromagnetic field (I_{e11}); 4.12. Lands with exceeding the permissible noise level (from the railroad and aerodrome) (I_{e12}); 4.13. Lands in the area of soil contamination (heavy metals) (I_{e13}).	DBN B.2.2-5: 2011 Improvement of territories; DBN V.2.1-10-2009 Bases and foundations of buildings
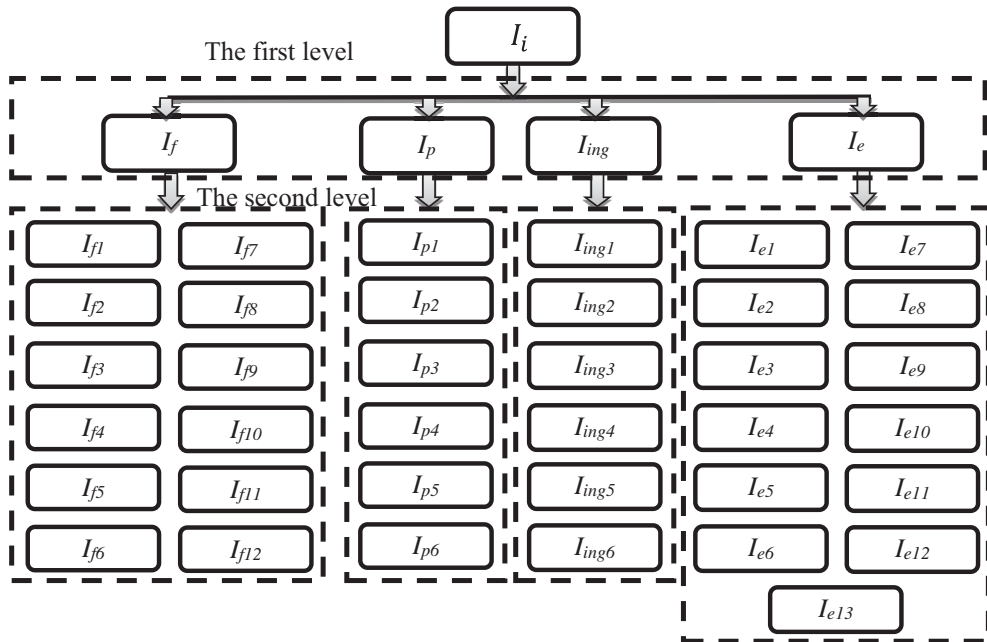
Fig. 1. The scheme of a two-level system of indicators, forming the investment attractiveness of the land of cities

Therefore, it is proposed to consider the information support as a set of functional-planning, territorial, engineering support and improvement of the territory, environment, ecology, historical and cultural indicators, which are formed on the basis of normative legal acts, systematization of theoretical and methodological provisions, considering technological features and factors, which affect the investment attractiveness of land. Therefore, in order to achieve the investment attractiveness of the lands of Ukrainian cities, as well as to maintain a high image of the country on the international scene, it is necessary to carry out a series of consistent and balanced measures by the state and the government. First of all, it is necessary to improve the legislative and tax base for the attraction of foreign capital in the sphere of investments, as well as to develop and adopt new laws, which would apply to all types of ownership forms. In the works (Sivelkin and Kuznetsova, 2013; Drozdovsky, 2004) it is noted that the registration and licensing procedures should be simplified, as well as the procedure for the participation of foreign investors in the privatization process of state property. Certainly, it is necessary to improve customs policy, to take measures to stimulate the free movement of goods, services, and capital both inside and outside the state. It is necessary to provide financial support from the state and reduce the level of political risk, as this is the main priority in making an investment decision.

Such measures will be able to improve the economic situation in the cities of the country and will help Ukraine to enter the path of stable economic growth. In order to make the investment climate of Ukraine more attractive, it is necessary to develop and consider the whole complex of these factors. Foreign investment is a vector for the

development of urban land relations. In order to increase the investment attractiveness of the country, it is necessary to carry out a complex of measures by the state and the government and to concentrate efforts on the realization of its competitive advantages, as Ukraine has powerful productive potential.

4. Discussions

Summarizing the analysis of the provisions for the assessment of urban land in Ukraine, it can be noted that the investment attractiveness of urban land is formed under the influence of a system of both generating and restrictive factors of technical, political, industrial, resource-based, innovative, social, human, financial, infrastructural, investment, consumer and environmental nature. It should be noted that each of the above-mentioned groups of factors is characterized by the possibility of internal differentiation depending on the structure of the regional system, as well as on the specifics of the functioning of the economic areas of the territory being assessed. Moreover, the larger the list of factors used in the evaluation process, the higher the probability of the results obtained. Thus, analyzing the existing theoretical concepts of technology for assessing the investment attractiveness of land cities of Ukrainian and foreign scientists and practitioners, we note that in this study it was proposed to apply the method of integral evaluation as the main element of the technology for determining the investment attractiveness of city lands, considering the influence of functional planning, territorial, engineering support and landscaping, environmental and historical and cultural factors.

5. Conclusions

Considering the existing directions for the implementation of technology for assessing the investment attractiveness of urban land, the following approaches have been proposed:
– economic, which includes the cost characteristics of urban land and is aimed at determining the economic effect of the formation, evaluation, use, and development of land. The implementation of the presented approach is carried out on the basis of the use of regulatory and expert assessment tools. Within the framework of the presented approach, the value of lands and their economic use is determined. Along with this, the significance and level of consideration of technical, spatial, environmental, and town-planning factors is reduced;
– spatial, which is based on the application of spatial factors, which are considered to assess the investment attractiveness of land in cities. At the same time, the main focus is on the creation of a completely functional system of geographically-bound information on the state of the land fund, which is formed when conducting a system for monitoring the investment attractiveness of land. This approach allows considering the important spatial characteristics of the land of cities. However, certain imbalances arise, as a result of which other important factors are not considered or are determined at a low level;

– complex, which includes a complex of interconnected stages aimed at selection of criteria according to expert opinion, which form the conditions for creating investment attractiveness and determine its level; realization of expert estimation and influence of each of the factors considering their mutual influence by means of determination of their weight coefficients; definition of indicators characterizing the investment attractiveness of the land of cities; estimation of the integral index, etc. The advantage of the presented approach application is the determination of a wide range of factors affecting the completeness and accuracy of the assessment of the investment attractiveness of urban land. In addition, it is important to determine the integral criterion as a synthesis for the development of measures to increase the investment attractiveness of urban land. However, there are problematic aspects regarding the formation and application of information support for assessing investment attractiveness and the indicators, which define it;

– multifactorial, the implementation of which is carried out through the prism of the assessment results of a factor set (political instability, lack of state guarantees, insufficient investor protection, imperfect legislative base, inflation, reduced privileges for investors, underdevelopment of the banking system). Within the presented approach framework, the level and completeness of the factors assessment of the urban land investment attractiveness are merit attention. However, there is a problem with respect to investment attractiveness. In addition, as in the previous approach, there are unresolved problems in the formation of information support;

– rating, which determines the ratings of each of the indicators, which form the investment attractiveness of the land of cities. It is characterized by investment risks and potential, which ensures impartiality of valuation, accessibility, and knowledge of the final results for foreign investors. In addition, the tasks of implementing the results of the comparative assessment of investment attractiveness and possible risks remain unresolved;

– an approach based on the tools and results of mathematical modelling, considering technical, environmental, social and economic factors, which influence the investment attractiveness of urban land. Using the tools of mathematical modelling, models are being built and relations between the factors influencing the investment attractiveness of the land of cities are formalized. This forms the basis for developing measures to improve it. However, there are problems with regard to the completeness and reliability of the existing information, spatial and urban development support for modelling.

Acknowledgments

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