State assessment of urban environment taking into account the development of engineering systems

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Abstract. In conditions of urban environment land resources have special importance as a valuable natural resource. This happens in our country in conditions of market economy development and formation. Cadastral and economic valuation of urban land is a part of inventory and urban planning policy. This research is based on the principle of market value, when the amount of land fees depends on the advantage of city position in the territory of the Russian Federation economic district and cadastral quarter on the plan of the city and the level of engineering systems development. The object of the research is Kursk. It is a regional center of Central Black Soil Region. The level of engineering systems development is an evaluation criterion.

1. Introduction
Land resources are a valuable natural resource for any country in the world. Urban planning and agriculture show poor land use due to low costs. Financial management of land resources is one of the main tasks of the State Land Cadastral of the Russian Federation. [1-7].

2. Research methods
Inventory and economic valuation of urban land is an integral part of inventory and urban planning policy. It should be defined in the development of urban land database. Ranking of the city territory according to a number of factors is an important component of urban planning policy. Normative price of land in combination with some factors characterizing the city is the research base. Kursk city is an object the research. It is a regional center of the Central Black Soil Region of the Russian Federation. Its population is about 500 thousand people.

There are various methods of urban land valuation (method of expert land assessment, method of analogues, method of integrated economic assessment of land by major factors, method of land estimating by one dominant factor and others). The principles of land valuation were firstly established by Governmental Decree No. 112 in 25th February 1992. There are factors which can make score cadastral valuation for all categories of urban areas in qualitative and quantitative combination [8-12].
The following factors can be used as valuation factors:
1. Historical and architectural importance of the territory;
2. Geographic position on the city map;
3. Development of social and household infrastructure;
4. Development of engineering systems and utility systems;
5. Transport characteristics of territories;
6. Ecological conditions of territories;
7. Proneness to natural hazards.

Cadastral value calculation is carried out according to the formula approved by the standards (1):

\[ CV = CVSI_{lp} \times S \]  

(1)

where \( S \) is the plot area, \( CVSI_{lp} \) is the specific indicator of the land plot cadastral value.

| Urban settlements | Permitted use No | Rural settlements |
|-------------------|------------------|------------------|
| Statistical model development or Market valuation | 1 | Alternative valuation on the basis of PU and US relations |
| | 2 | Statistical model development |
| | 3 | |
| | 4 | |
| | 5 | Alternative valuation on the basis of PU and US relations |
| | 6 | |
| | 7 | |
| | 8 | |
| | 9 | |
| | 10 | |
| Market valuation | 11 | Market valuation |
| | 12 | |
| | 13 | Alternative valuation on the basis of minimum CVSI for Urban settlement (US) with permitted use (PU) 9 |
| | 14 | Alternative valuation on the basis of the mean CVSI of forestry fund |
| | 15 | Alternative valuation on the basis of CVSI of agricultural lands |
| | 16 | Nominal value |
| | 17 | Statistical model development or market valuation |

*Permitted use types definition

| No | Types of permitted use (PU) |
|----|-----------------------------|
| 1  | Land plots for high-rise residential development |
| 2  | Land plots for private house building |
| 3  | Land plots for garage and parking areas |
| Land plots included in dacha, horticultural and gardening associations |
| Land plots for shopping facilities, public catering and personal service facilities |
| Land plots for hotels |
| Land plots for business and commercial office buildings |
| Land plots for recreation and medical recreation facilities |
| Land plots for manufacturing and administrative buildings, industrial structures and facilities, utilities, facilities for material and equipment, food supply, sales and storage |
| Land plots for power stations, and their auxiliary facilities |
| Land plots for harbors, railways, marinas, airports, aerdromes, airport buildings |
| Lands plots of water bodies in circulation (In Kursk region, there are no land plots of this type of the permitted use in the valuation object list) |
| Land plots for resource development, railway tracks, motorways arrangement, man-made water ways, quays, jetties, railroad precincts, easement areas of roads, water ways, pipelines, cable lines, radio relay links and aerial lines of communication, broadcast system lines, overhead electric lines of structural components and facilities, facilities required for operation, maintenance, construction, redevelopment, repair works, development of above-ground and underground buildings, facilities, structures of transport, power and communication facilities, placement of above-ground facilities and infrastructure for satellite communication, space and military facilities |
| Land plots of areas and facilities of special protection, urban forests, miniparks, parks, urban gardens |
| Land plots for agricultural use |
| Land plots for streets, avenues, squares, walks, boulevards, gateways, lanes, driveways, blind alleys and reserve lands, land plots occupied with water bodies taken out of circulation or with limited circulation according to the laws of the Russian Federation |
| Land plots for administrative buildings, educational, scientific, public health, social service facilities, physical culture and sport facilities, culture, arts and religion facilities |
We use methodology of cadastral valuation of land resources on several factors. The territory of Kursk city is estimated by 10-point scale and is preliminary divided into cadastral quarters (isochronous, contour) on the scale of the map. Integral score valuation is the result of the research. It is calculated by formula 2:

\[
S = \sum_{i=1}^{n} F_i * K_i / \sum_{i=1}^{n} K_i
\]

where S- value of the territory in scores; Fi- value in scores on each factor; Ki – input of i factor into value of the territory in %; i - factor number.

3. Research results

Input is the degree of factor influence on a certain cadastral quarter. The impact of each factor on presented categories of land use is described in Table 2. 4 factors were formulated for Kursk city on the basis of available statistical and cartographic material.

| No | Factors | Categories of land use | Dormitory suburb | Industrial | Commercial area |
|----|---------|------------------------|------------------|------------|-----------------|
| 1  | Development of engineering and utility systems | 30% | 50% | 30% |
| 2  | Level of social infrastructure | 15% | 9% | 10% |
| 3  | Transport characteristics of | 30% | 30% | 35% |
| 4  | Ecological conditions | 25% | 11% | 25% |
|    | Total | 100% | 100% | 100% |

The distribution of major types of engineering systems is generally related to number of storey in a building with some local exceptions. According to chosen methodology 10 is the maximum score. This is the territory where cadastral quarters with all engineering systems are located. The valuation scale has been done on this basis. Table 3 shows an example of the valuation. [13-17].

| No | Engineering structures and systems | Valuation in scores |
|----|-----------------------------------|----------------------|
| 1  | Territories have all the engineering systems | 10 |
| 2  | The territory has water supply, sewerage, heat supply, gas supply, electricity supply but there is no phone line | 8 |
| 3  | The territory has water supply, sewerage, heat supply, electricity supply, gas is imported (liquefied in cylinders and there is no phone line) | 6 |
| 4  | The territory has only water supply, sewerage and electricity | 4 |
| 5  | The territory has only electricity supply, water supply is through | 2 |
| 6  | Territory has only electricity supply | 1 |
4. Conclusions
Territories with the same scores are combined into zones taking into account the scale. The most affordable development of engineering infrastructure is by numbers of storey in a building. Map symbols are marked on the map of numbers of storey in buildings of the city (Figure 1). [1-3,7-9, 18,19].

| No | Storey | Engineering systems                                           | Graphical symbols |
|----|--------|---------------------------------------------------------------|-------------------|
| 1  | 1-2    | Water supply is not centralized, gas is imported, there is   |                   |
|    |        | electricity supply                                            |                   |
| 2  | 2-3    | Water supply is from tanks, there is gas and electricity supply|                   |
| 3  | 4-9    | There are all the systems                                    |                   |

**Figure 1.** Map of number of storeys in Kursk.

Assessment of Figure 1 contours was done on the basis of obtained analytical data of engineering systems development in Kursk. The results can be used in comprehensive economic assessment of the land of Kursk city.

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