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Modelling of the Parcel Pattern Impact

To cite this article: W Mingming *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **272** 032085

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Modelling of the Parcel Pattern Impact

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Abstract. This paper studies the issues of parcel patterns' determination, the direction and the usage of local parcel patterns are described. This article provides the usage of the geoinformation analysis for parcels' allocation of the city. The activity sequence for the choice of such parcels is developed with the application of geoinformation support. They have been set up the geoinformation models of the pattern impact (distribution pattern over a distance) on the cost of each separate parcel by means of their cost surfaces which provide with an opportunity of rating, analysis and forecasting of land cost.

1. Introduction

In the present context the development of land relations, the extension of city limits, the decrease of effectiveness of land usage require the reconsideration of reproaches to their management. In this regard the direction observation of modelling of the parcel patterns is of key importance, that lays the information foundation for the effectiveness improvement of their usage. It is necessary to indicate the low level of the theoretical and methodological study of the definition of parcel patterns, their modelling in the present context of urban development.

2. Main Part

Different approaches to the definition of pattern exist in the present research papers. In general terms it is characterized as sample, similarity, repeating objects [1]. In the context of the definition of parcel pattern, V. Shypulin's point of view is important, he examines it in the system of land administration, which is formed with the relationship of objects, relations, subjects [2]. It's worth noting that the definition of parcel patterns is used for the realization of their assessment in the land relation system of the metropolis. The offered models of parcel patterns deserve attention: PLCC, PQFP, SOP, SSOP, TSOP and SOT-23 [3]. Some researchers focus on the instruments of pattern formation, the construction of the appropriate templates of parcels. For example, PADS VX makes it possible to boost production of the parcel pattern formation [4]. The instruments such as IPC-SM-782 Surface Mount Design and Land Pattern Standard are also used for the construction of patterns [5, 6]. The methods of remote sensing and geoinformation analysis are used while forming the parcel patterns. Thereby, a pattern is a distribution structure of parcels of monetary value along the city, that has important significance for the secondary data calculation and usage in the relevant assessment. The



study of parcel patterns aims to find the definite regularities in the arrangement of assessment objects, reasons of such arrangement, spatial relationships.

The data of the primary market and the secondary market for land are used in the capacity of basic data for fixing the parcel distribution. The criteria of the study subject selection are:

- information accessibility;
- reliability;
- enough information for the achievement of the statistical property results;
- the presence of different parcels by the pragmatic use.

The object data of the primary market can be presented as the land buyout data of the city of the parcels under the real property that belong to the appraiser including commercial, industrial, housing usage.

The object data of the secondary market are received from the estate agent's offices. The building parcels of commercial use and the service of block of flats are mainly included to the data of the secondary market for usage function, the parcels for commercial use and the parcels for gardening on the territory of the gardening partnership are also included.

In order to get information about the distribution of parcels along the city the shapefile of the parcels is created, it is independent for every type of the market.

The coordinates of parcels, centroids or building addresses are used as the spatial data.

The table of the shapefile attributes including compulsory data fields on the cadastral number, address, use, site value, area, date of decision on the sale for the primary market, indexation coefficient on the date of analysis, indexed cost of 1 sq m, correction for bargain case of the secondary market objects, and a number of coefficients according to the normative and guideline acts are used within the meaning of the normative monetary value namely: coefficient of the functional use, regional coefficient, integral local coefficient.

Special focus should be placed on the parcel cost. For the parcel use of such parcels (analogues) they carry the cost to the same date of the carrying-out of the analysis. Each parcel is defined by the date of sale and the cost. For using such data in the system it is necessary to bring all the costs to the common date. Such an reappraisal may be carried out with the help of the inflation indexes that are calculated according to the statistics and are published every month. The cost of one square metre of the parcels was multiplied by the corresponding coefficient that conforms to the alteration of the time value of money for the period of the date of the given parcel sale to the date of analysis.

The parcel distribution along Kharkov is represented on the map by the point features - centroids, the attributes of the point layer contain the characteristics of the parcels (see Fig. 1).

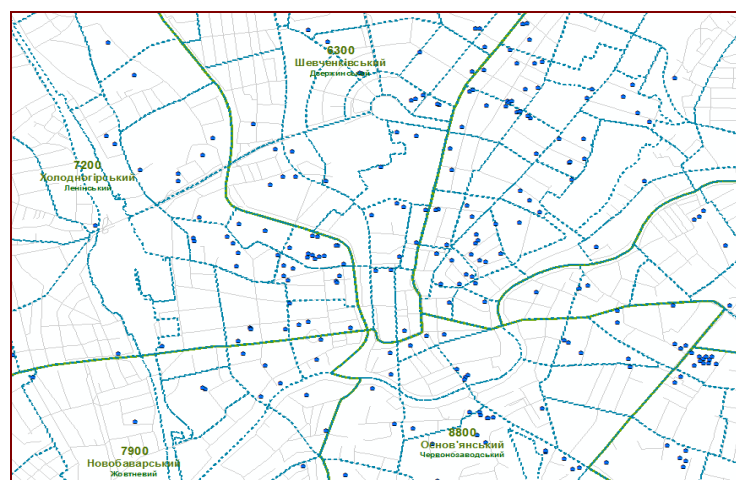


Figure 1. The scheme of the parcel distribution along Kharkov.

For the apparent position finding of the great number of parcels the electronic map contains the overlay of geographic data:

- city limits;
- wards;
- economic and planning areas;
- city streets;
- objects of rapid transport;
- water objects;
- other sources.

On the grounds of the data of land market the tabular and spatial analysis of the parcel distribution is carried out using the instruments of point pattern analysis: areometer analysis, nearest neighbour analysis, block analysis, analysis of Thiessen polygons.

The option of such city parcels is exercised for modelling of the impact of the spatial parcel patterns on the real estate appraisals.

For the option of such parcels the geoinformation security includes a set of tools which take into account the location and the attributes.

The original layer is the layer over which the parcel distribution of the expert monetary evaluation is set up. For the option of analogues it is possible to create a point layer with a point object of the parcel location whose region analysis should be carried out.

The following activity sequence was worked out for the option of such parcels using the geoinformation application:

1. The spatial query is formed with the help of the instrument Select by Location (selection out of location). For example, to select the analogues of the commercial use which are settled at 1 km from the appraised parcel. The necessary parameters, such as distance for option, are fixed in agreement with one's own understanding and the number of data contained in the system.

2. SQL-correlation is formed with the help of the instrument Select by Attributes (selection out of attributes), for example, to select earlier chosen parcels of commercial use with the square more than 0,1 hectare and less than 0,5 hectare and those that were bought without instalment.

3. The table of the selected parcels is formed with the help of the instrument Data management tools of the insert Tools named Copy Rows, it is used for the following making amendments into the cost and for the assessment of appraisal value of the parcels.

4. The instrument Copy Features of the insert Features can be used for copying. Using this instrument the spatial objects and their attributive data will be copied.

The amendment into the parcel cost in situ takes into account how the presented place and the parcel cost differ from the analogue. In general terms the correction cost in situ is defined by the model where the cost of one square metre of object cost and the analogue and the coefficient of correction in situ are taken into account.

The assessment of the represented coefficient is carried out using trade lines that allow to reflect graphically the data tendency and to predict their further changes. Such analysis is characterized as autoregressive with the help of which the prediction of the parcel cost is exercised.

A distance to the parcel with the highest cost of one square metre in the city is determined as a parameter that reflects the difference in situ.

The direction of the coefficient assessment in situ is proposed by the author:

1. One creates the point layer of parcels of the scientific assessment and selects the parcel with the highest cost of one square metre.

2. With the help of the instrument Point Distance of the insert Proximity in the set of tools Analysis tools one makes the table of distances from the parcel with the highest cost of one square metre to each parcel. The initial table of distances is united with the corresponding table of attributes of the parcel layers which are defined in terms of the scientific assessment by the identifier.

3. The point diagram is made according to the data of distances from the parcel with the highest cost of one square metre to each parcel. The distance to the centre is plotted along the absciss, the parcel cost of one square metre is plotted along Y-axis.

4. In order to reveal the trends one selects a pattern and plots a trend line which most closely reflects the cost dependence of one square metre on the distance to the objects of the urban realm.

5. The equation starts running, it depicts the relation of the accuracy quantity of approximation between the cost of one square metre and the distance to the objects of the urban realm.

The modelling of the correction test in situ is defined by the cost value of one square metre of the examined property to the corresponding cost of the analogue.

The correction test in situ is carried out on the basis of point test of 470 parcels. And here is the dependency diagram (Fig. 2).

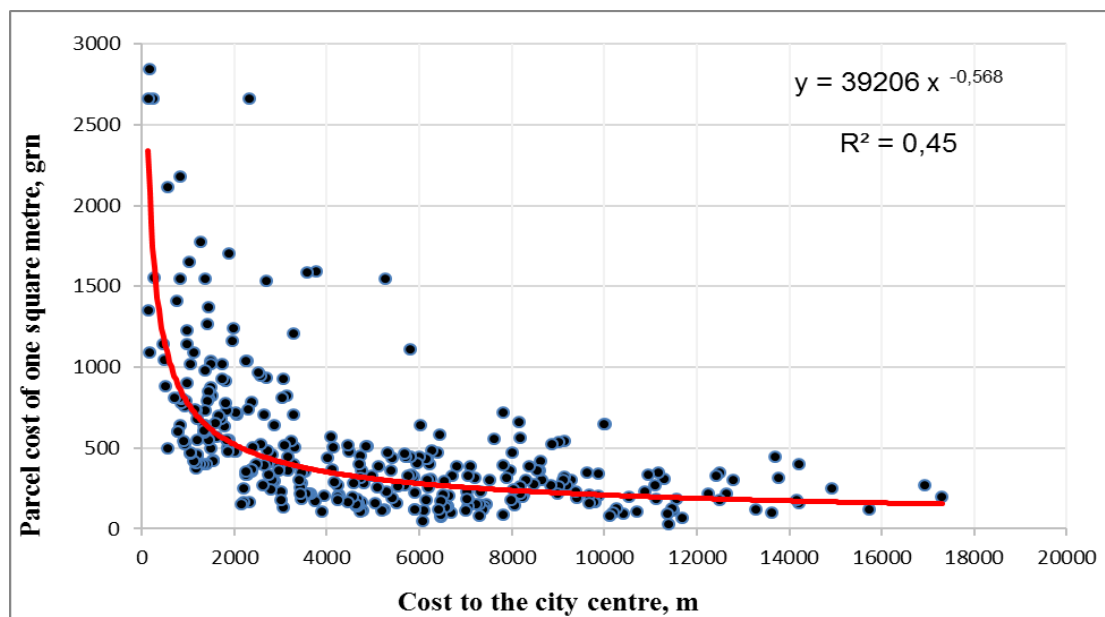


Figure 2. The dependency diagram of the cost on the distance to the centre of Kharkov.

As a result of the research it was established that the trend line of the cost dependence from the distance to the centre of Kharkov is characterized by the model of step function:

$$y = 39206 x^{-0,568}. \quad (1)$$

The accuracy quantity of approximation is equal to $R^2=0,4509$.

Based on the model (1) the correction value is:

$$K_M = 39206 x_o^{-0,568} / 39206 x_a^{-0,568}, \quad (2)$$

where x_o - distance from the centre to the appraisal object;

x_a - distance from the centre to the analogue parcel.

Using the represented model they are applied the objects that have comparable location and other spatial factors which influence the formation, the distribution and the use of parcels.

They are worked out the geoinformation models of the pattern impact (distribution pattern over a distance) on the cost of each separate parcel in the form of their cost areas (Fig. 3) that provide an opportunity of assessment, analysis and prediction of land cost.

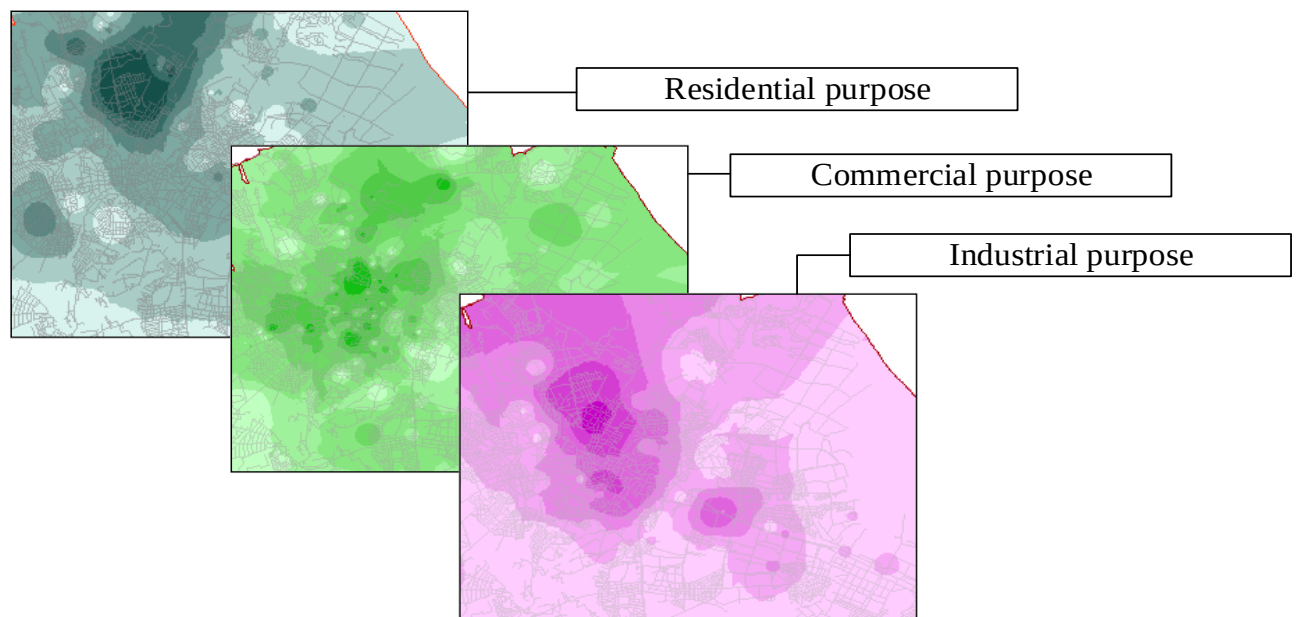


Figure 3. The areas of the parcel value of residential purpose, commercial purpose and industrial purpose.

3. Conclusions and proposals

On the basis of the research we have carried out the modelling of the impact of spatial factors on the different levels of parcel usage for formation and realization of land attitude of the metropolis, we suggested the approach on the basis of which they are developed facilities for the rise in the efficiency of made decisions by applying of geoinformation, informational and analytic and spatial procurement of monetary value of metropolis ground.

Suggestions of the further research are the formations of organizational and methodological mechanism for forming and usage of parcel patterns of the metropolis.

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Acknowledgment

This article has receive dsupport of the project of University Nursing Program for Young Scholars with Creative Talents in Heilongjiang Province (No.UNPYSCT-2016099).