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## Creation of new jobs and creativity of the urban space

Over the last decades industries, that affect human capital development, have stepped into the spotlight. Engineering companies, creative and service enterprises have assumed a crucial role in the urban economy and its potential. As for large urban agglomerations, new forms of production and creative class mobilization represent the key objectives due to the reduction or liquidation of the majority of industrial urban enterprises.

Urban planning as a science is responsive to economic changes. The paradigm of functional zoning has been replaced by theories based on land use intensity, business and cultural activities of population. Hence, the idea is to ensure the polyfunctional operation of industrial, high-tech research companies in residential areas and to relocate housing to areas occupied by old industrial enterprises.

In this work, the co-authors analyze the phenomenon of the location value in a modern city, regularities that govern the choice of locations for new enterprises; they also suggest approaches to the zoning of urban areas depending on their potential ability to develop new types of industrial production.

**Keywords:** *surveying, value of a territory, zoning, urban and regional clusters*

### THE VALUE OF AN URBAN AREA

In the surveying system, the understanding of processes of territorial, spatial and economic development of cities intrinsically encompasses the analysis, design, examination, and management of the urban environment (UE) and items of real estate as its constituents [1].

Most of the researchers believe that the set of tasks, related to the life cycle of a construction facility in time and space, depends on multiple factors: from the value and function of a facility to the assessment of its location, area, and a number of subjective factors. In the surveying system, this set of tasks is clustered into the concept of urban planning: identifying the most suitable conditions for the best, the most effective solution that encompasses the composition or decomposition of the key elements of form, function, and structure of an urban space. Each time the life cycle of a construction facility is identified with regard for its economic, social, and urban planning environment, let alone the origin of the city and the construction facility under research.

Of interest is the analysis of the life cycle of industrial production, that goes down into history, and the post-industrial period of new types of production activities, their interaction with the general construction plan, as well as the valuation and assessment of the unique nature of a business facility and land appraisal.

Understanding the surveying system as a general theoretical approach allows to make decisions at the most important project stages, starting from the general layout plan and masterplan and ending with construction and operation.

The city demonstrates regression to the Middle Ages: "cities were founded in marketplaces only", where production reached consumers. Not all fortresses developed into cities, but only those whose location, or urban land, was valuable.

In a modern city, innovations are drivers of valuation differences. As a rule, innovations emerge at the intersection of science, education and business.

Urban land, or "localities" have different characteristics and different values. This concept serves as the basis for a fundamental research into characteristics and functions, that determine the value of a locality, an urban agglomeration and the entire life cycle of a construction facility.

Over the recent decade of the 21st century, the theoretical concept of urban space and its value has served as the basis of continuing research.

A well-known formulation that reads as "A HOUSE or A ROAD", which is the simplest metaphoric characteristic describing the origin of an item of real estate, will remain a permanent determinant that identifies the properties of a construction facility.

If the road takes the shape of a river, the road dominates, and if the road occupies the space left in-between the houses and its shape is almost unpredictable, it is nothing more than a mere function.

In the course of centuries, it accumulated numerous functions. And then comes the stage of its valuation through surveying that deals with economy or an economic problem. It is not a simple one, since it deals with the price rather than the value. Surveying encompasses examination, organization, valuation, economics, and operation. [2]

### THE RELEVANCE

The problem of siting urban working spaces is truly acute. If in the 20th century 80 % of the population was engaged in the production of industrial goods and agricultural products, in the 21st century mere 20 % of the population is employed in the industrial sector [3]. Now that the majority of urban residents is engaged in unproductive labour, opportunities open up for the "creative class" [4, 5].

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1. Identifying the industries that serve as drivers of the urban economy;
2. Assessing the availability of clusters at the urban level;
3. Assessing cross-sectoral links;
4. Analyzing spatial regularities that govern the siting of promising industries;
5. Ranking competing areas based on the cluster potential and transport infrastructure development.

This stage should result in the draft map of urban zones of the cluster potential and a ranked list of competing urban sites.

#### *Identifying the industries that serve as drivers of the urban economy*

We used the Central Statistical Database of the Federal State Statistics Service of the Russian Federation to find out the number of employees broken down by the economic activities [9].

This statistical information serves as the basis for calculating three quantitative indicators [10–12]:

- LQ (specialization): this indicator shows how the weight of a cluster in a region exceeds the weight of a given industry on a national scale.
- Size: the ratio of the number of employees in a given regional cluster to the number of people employed in the industry on a national scale.
- Focus: the ratio of the number of employees in a given regional cluster to the overall employment in the region.

Having performed the calculation of quantitative indicators and grouping, we obtained five key creative clusters, including research

and education, IT, tool engineering, media, pharmaceuticals and new chemistry (see Table 1).

#### *Clustering new industries at the urban level*

Spatial autocorrelation is applied to identify the presence or absence of clustering. Spatial autocorrelation [13] is a measure of spatial dependence, association or correlation between the analyzed values that apply to the same attribute of adjacent spatial facilities (Fig. 2).

Global spatial autocorrelation is typically calculated as Moran's I index. It is interpreted subject to the anticipated value calculated using the null hypothesis about the absence of spatial autocorrelation (complete spatial randomness).

In case of random distribution, the anticipated value of Moran's I Index tends towards 0. Positive (observed) Moran's I Index values, that significantly exceed the anticipated value, indicate clustering and positive spatial autocorrelation (i.e., adjacent localities have similar values of the attribute). Negative (observed) Moran's I Index (Fig. 3) values that are much smaller than the anticipated value, indicate negative spatial autocorrelation (i.e., adjacent localities have widely varying values of the attribute). Moran's I Index values, that are close to the anticipated value, indicate the absence of autocorrelation.

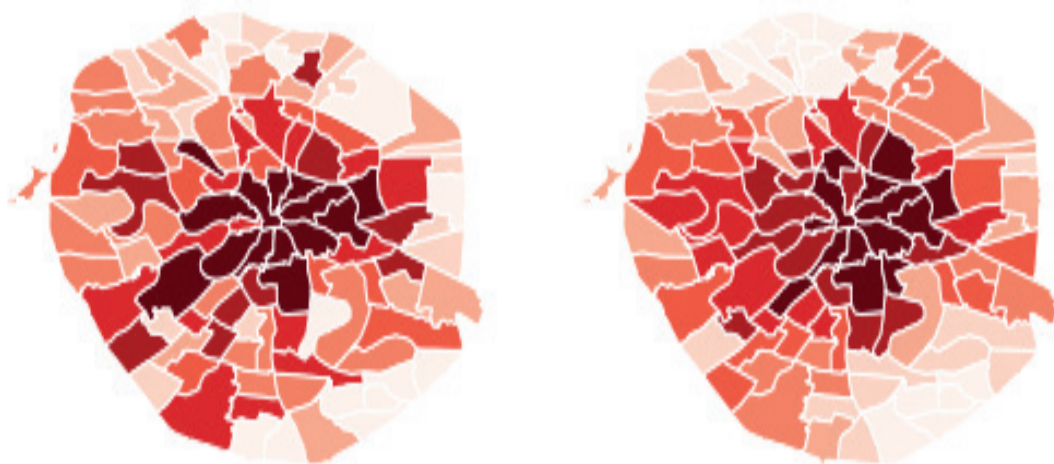
In this case, Moran's I index (0.44) differs significantly from the random distribution. We can observe concentration and sparseness of high-tech companies within the Moscow Ring Road.

#### *Assessing cross-sectoral links*

A graph of relatedness of industries was made on the basis of statistical information about the collocation of companies. There,

*Table 1. Creative clusters in Moscow*

Cluster name	Number of jobs	LQ	Size, %	Focus, %
Media	85,739	3.4	28	2
IT	203,819	1.1	1.1	18
Tool engineering and mechanical engineering	114,292	1.4	1.4	8
Research and education	402,661	2.9	2.9	25
Pharmaceuticals and new chemistry	12,673	1.2	12	0



*Fig. 2. Distribution of technology companies by districts of Moscow within the Moscow Ring Road (left), taking into account the spatial lag (smoothing) (right)*

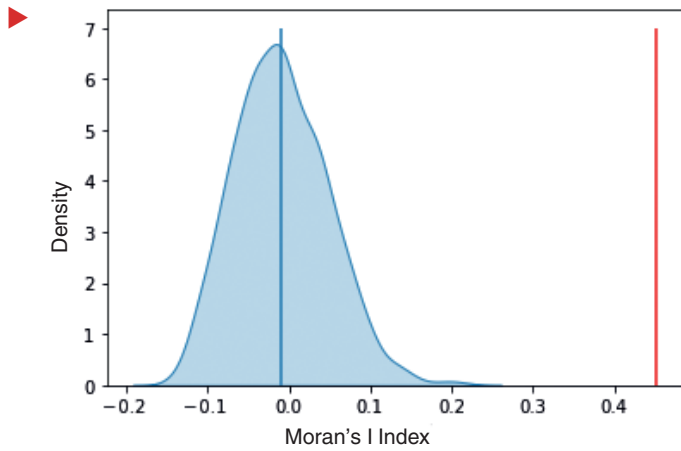


Fig. 3. Random and actual values of Moran's I Index

the node size characterized the number of companies in a particular industry, and the arc size characterized the number of companies that had cross-sectoral links (Fig. 4).

Principal Moscow high-tech industries include the tool industry and mechanical engineering, biotechnology, IT, and the chemical

industry. These industries demonstrate high compatibility, if they share premises.

*Evaluating the siting patterns of promising industries*

In the context of this research, it is vital to understand how new companies interact with other objects in the urban environment, including the supporting infrastructure (universities, research centres, science parks) (Fig. 5), old industrial zones, the ecological situation, points of attraction, and transport [14].

The study shows that high-tech companies demonstrate concentration patterns similar to those of other urban points of interest. Many companies are concentrated near science parks and creative spaces. We have identified that new companies are concentrated at a distance from old industrial zones. New companies do not affect the environmental situation (Table 2).

*Ranking competing areas by their cluster potential and transport infrastructure development*

Moscow industrial zones, which can be exposed to renovation, are assumed as optional territories that can accommodate new clusters. Sixty existing industrial zones have been selected.

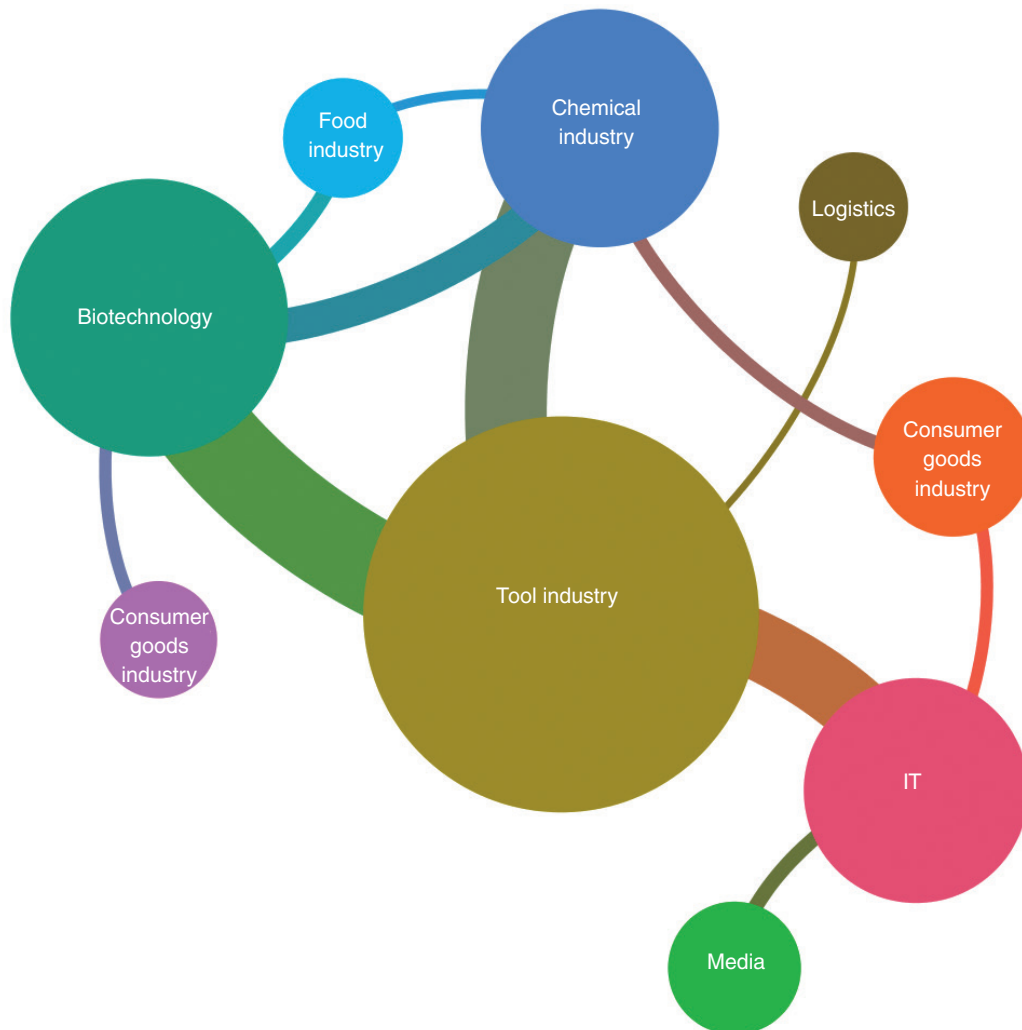


Fig. 4. Graph of cross-sectoral links

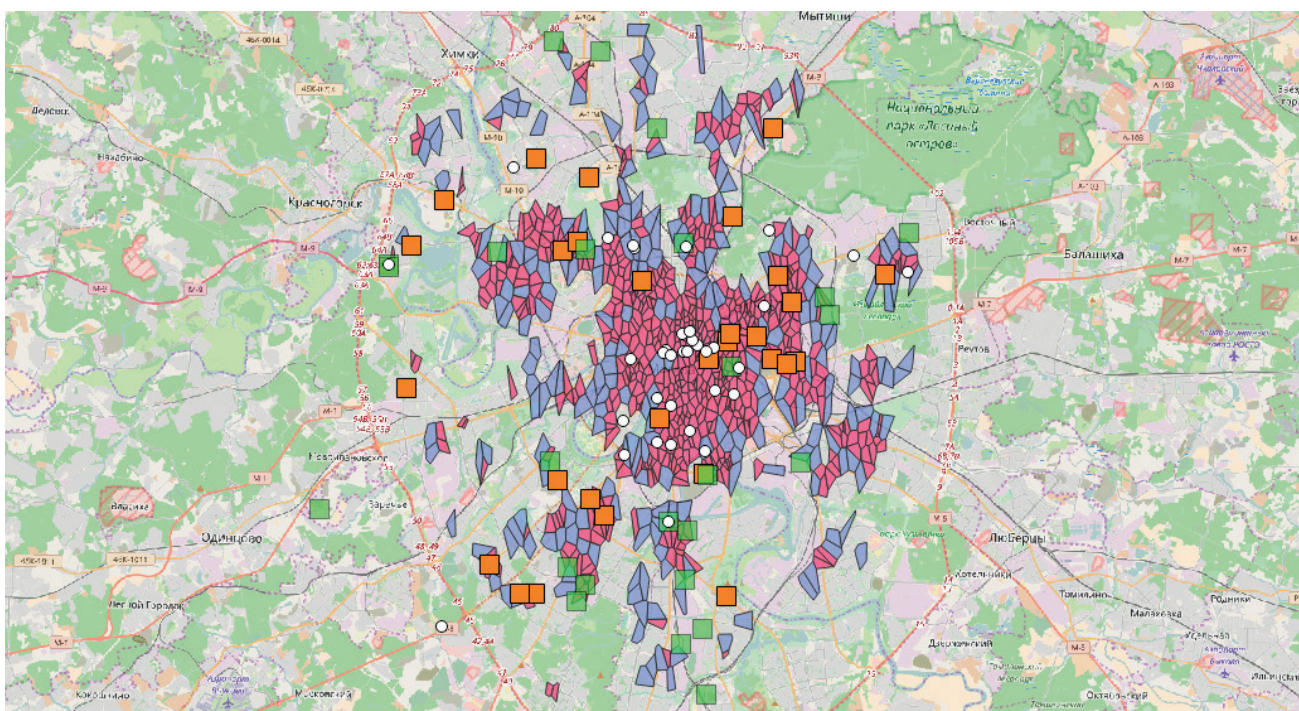


Fig. 5. Collocation of urban areas demonstrating most intensive economic activities and innovative infrastructure in Moscow: technical universities (orange squares), science parks (light green squares), co-working spaces (white dots)

Table 2. Spatial interaction between new industries and elements of the urban environment

Urban environment	Spatial location correlation, %
Universities, science parks, creative spaces	80
Industrial zones	10
Ecology	5
Points of interest	96
Transport accessibility	83

Core attributes were identified for each industrial zone, and the following factors were formulated on their basis: transport accessibility, the number of corporate participants, social security offices, leisure and cultural institutions, ecology [5].

A site scoring model can be used to rank industrial areas:

$$Q = \sum_{j=1}^m \sum_{i=1}^{n_j} \frac{Q_{ij}}{n_j} w_j, \tag{1}$$

where  $Q_{ij}$  is the score of the  $i$ -th indicator of the  $j$ -th criterion;  $n_j$  is the number of indicators of the  $j$ -th criterion;  $w_j$  is the weight of the  $j$ -th criterion;  $m$  is the number of criteria;  $i$  is the performance measure of the  $j$ -th criterion;  $j$  is the criterion.

For ranking purposes, an assessment based on the following set of criteria was applied:

*The transport criterion* is characterized by the position of the area within the urban structure and the extent of development of the transport infrastructure, including the road network density, the number of public transport stations, and the availability of places of residence.

*The research/production criterion* is characterized by the availability of clustered industries, science parks, creative spaces, co-working spaces, educational institutions, and R&D organizations.

*The recreation criterion* is characterized by the location of cultural, leisure, social facilities.

*The landscape/composition criterion* is characterized by the location of historical buildings, visual connection with the city centre and architectural ensembles, and the extent of the natural landscape preservation.

*The environmental criterion* is characterized by the environmental situation in the territory and the presence of hazardous industries.

These criteria are not assessed by experts; they are calculated using quantitative data that have a spatial reference. The advantage of using geoinformation data consists in the ability to simultaneously co-evaluate a large number of alternatives without having any experts involved. An expert opinion is only needed to determine the weight of the criteria (Fig. 6).

Given the zoning results, Sokolinaya Gora and Kalibr industrial zones are the most attractive locations for new clusters (Fig. 7). They can accommodate new science parks or existing ones. The choice of a science park as the type of location for new production facilities is based on the current extent of development of industrial zones, the size of land plots and effective urban planning standards.

► FURTHER RESEARCH

Although the above approach allows classifying or zoning urban territories into high, medium and low potential areas in terms of the location of cluster companies, it does not allow for the scientifically grounded distribution of jobs.

The distribution of jobs in the city can be regarded as a global optimization problem. Basic prerequisites that underlie the algorithm include:

1. Maximization of the multi-criterial assessment of a location: a designer should be able to flexibly choose optimal location criteria;

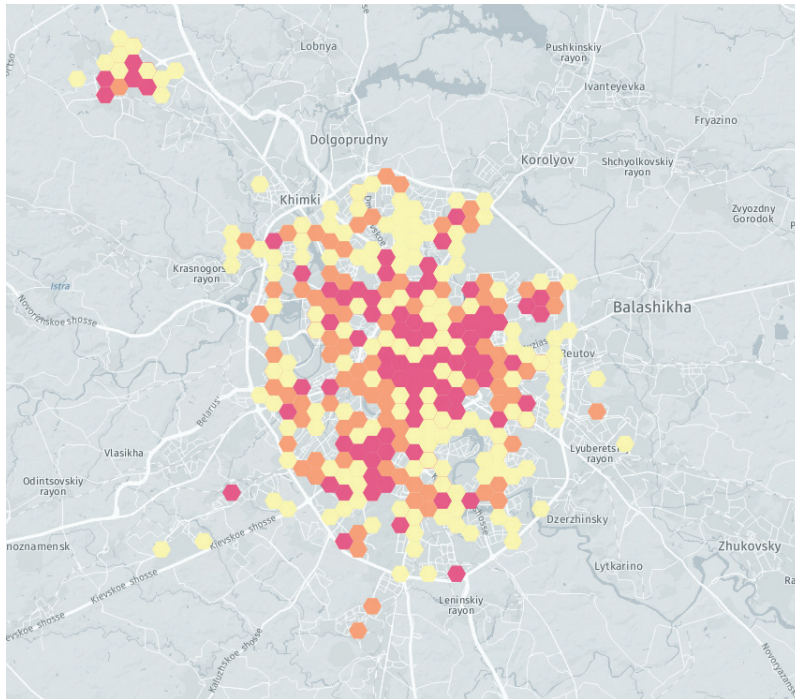


Fig. 6. Urban territory zoning according to the cluster potential: the darker the zone, the higher the potential

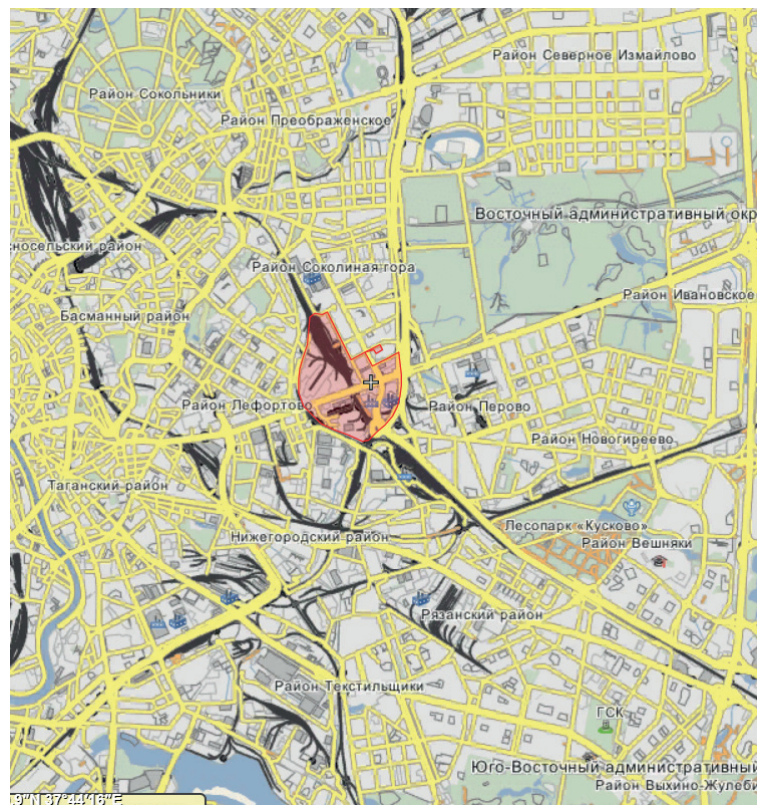


Fig. 7. Sokolinaya Gora industrial zone

2. The algorithm should take account of the spatial context: any spatial object is not independent; the simulation of spatial links requires the analysis of indicators in respect of the territory under consideration and its environment;

3. A designer must have control over the values describing the concentration and dispersion of new jobs.

Hence, the optimal way is to use genetic algorithms [1], a type of combinatorial optimization algorithms. The strengths of this approach encompass the ability to find the global maximum, the ability to optimize non-smooth functions and obtain the optimal solution and variations that are close to it.

In the terminology of genetic algorithms, the individual (the sought-for option) can represent a vector of distribution of new jobs across districts or territories in a city that has a completely different size. The fitness function can result from the multi-criterial assessment of location with account for the spatial lag and Moran's I Index. The tournament principle can be applied to choose the options at each iteration of the genetic algorithm.

## CONCLUSION

The zones, featuring the concentration of technology intensive businesses, and sparseness zones have been identified. Concentration zones may mean the availability of favorable conditions for a particular type of business, while sparseness zones indicate the insufficiency of initial conditions needed for new clustered production facilities.

There exists a positive interrelation between business activity growth in a given territory, including the economic activity of clusters, and the cost of residential and office premises.

Clusters are powerful centres of attraction, as well as centres of culture and science in any city.

The main decision making factors, that impact the choice of location for new industrial production facilities in a historical industrial zone, are the availability of a focal industrial facility in operation, and, to a smaller extent, the environmental situation in the territory adjacent to the industrial zone.

Old industrial zones are not attractive for new production facilities; they need comprehensive renovation.

Sokolnaya Gora and Kalibr industrial zones are the most attractive industrial areas for new types of industry.

## Создание новых рабочих мест и креативность городского пространства

В последние десятилетия на первый план вышли отрасли, связанные с развитием человеческого капитала. Инжиниринговые компании, предприятия креативных индустрий и сферы услуг стали играть определяющую роль в экономике города, его экономическом потенциале. Для городских крупных агломераций размещение новых форм производства, привлечение креативного класса является ключевой задачей ввиду сокращения или ликвидации большинства индустриальных предприятий города.

Вместе с экономическими изменениями меняется и градостроительная наука. На смену парадигме функционального зонирования пришли теории, основанные на признаках интенсивности использования территории, деловой и культурной активности населения. Появилась идея полифункционального размещения производственных, научных высокотехнологических компаний в жилых зонах и жилья на территории исторически сложившихся промышленных предприятий.

В данной работе авторы анализируют феномен ценности места в современном городе, закономерности размещения новых предприятий, а также предлагают подходы к зонирова-

нию территории города по потенциалу развития новых видов промышленного производства.

**Ключевые слова:** сервейинг, ценность территории, зонирование, городские и региональные кластеры

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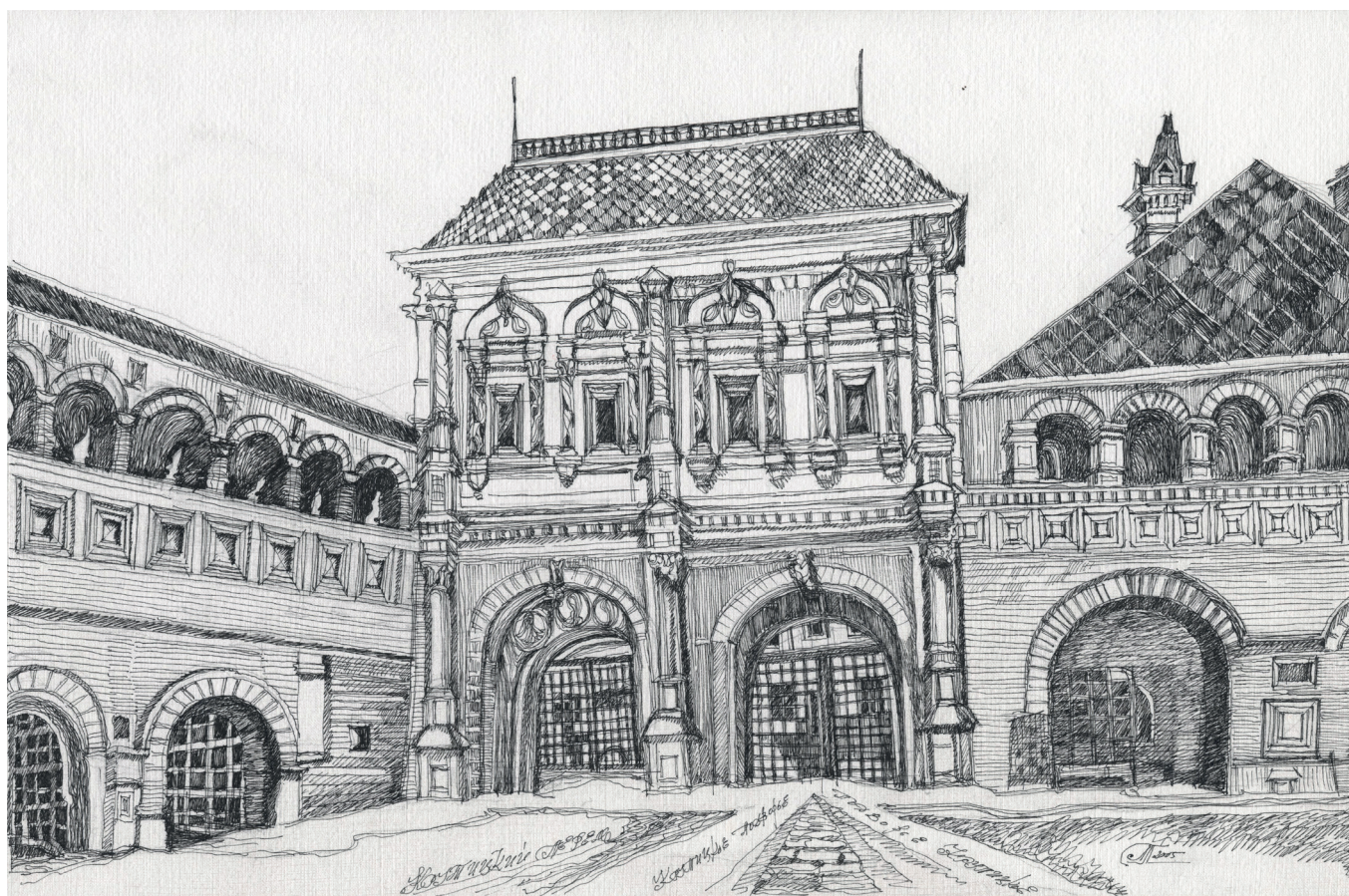
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