Differentiation of Russian megacities by level of investment in comprehensive residential development

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Abstract. The paper presents main findings of the research on Russian major urban centers differentiation according to rates of investment in comprehensive urban development. Thorough investigation of current research on the nature of comprehensive urban development allows authors to define main indicators that determine the demand for residents’ vital needs satisfaction through public amenities provision. A review of global trends in Smart urban development resulted in proposing several hypotheses on contemporary conditions of comprehensive urban development in major urban centers. These hypotheses are aimed at integrating available statistical data on residents’ vital needs satisfaction. Comparative analysis is conducted via STATISTICA software package with the use of hierarchical agglomerative clustering method. The clusters of Russian cities are formed using differences in the variables of investment rates in principle areas of comprehensive urban development. As a result of comparative analysis, authors describe two clusters of Russian major urban centers: urban centers that are showing high rates of investment in public amenities like kindergartens, schools, medical clinics; and cities that are clearly lacking sufficient investment in comprehensive urban development.

1. Introduction

At the current stage of socioeconomic development, construction and residential development undergo a major transformation in the composition of available types of permanent facilities. Government preoccupation with real estate and construction policies impacts not only housing provision, but also results in prioritizing quality of life through public amenities provision, which is highly dependent on available resources, as well as current investment and construction policies. Current research in residential areas development demonstrates that the emergence of the idea of comprehensive urban development is closely connected to changes in domestic housing construction [1-5]. The origins of comprehensive urban development are traced by researchers [1] back to the period between 1960s and 1980s. During this time a number of factors accommodated the rising interest in quality of built environment, including new technologies of standardization in housing construction, increased demand for housing, and increased government expenditure on public amenities provision. New legislation also ensured that planners are bound to achieve a certain quality of life when planning new
territories [3,4]. Comprehensive development remained main guiding principle in residential development and construction until 1990s.

Government involvement in regulation of real estate and construction drastically decreases during 1990s, resulting in lack of attention to comprehensive urban development plans. New investments in residential construction were also slowed down by negative demographic trends, namely – significant drops in birth rates and high rates of unemployment [4-6]. Contemporary legislation, on one hand, revives the notion of comprehensive residential development, requiring provision of high quality of life, safe and sustainable built environment, as could be seen in research [7-9] and planning documents [10]. On the other hand, normative declaration of comprehensive urban development principle is significantly contradicted by practice [10,11].

Goals of housing policy remain vaguely defined and do not allow municipalities to set their development goals properly, which in turn leads to difficulties in analyzing the quality of built environment, identifying priorities and crucial needs in public amenities construction, and providing strategic policies for future investments. Comparative research is viewed as a legitimate source of information about current state of built environment in clusters of similar cities, grouped together on the basis of investments in public amenities [12]. Since the notion of quality of built environment is heavily influenced by societal changes, city’s position in any of such groups might determine the quality of its built environment and quality of life of its population.

2. Research problem definition
The need for spatial organization of urban space as safe, sustainable and pleasant is accompanied by major societal and economic developments and increase in overall condition of urban environment. Thus, the definition of comprehensive urban development, which can be described as a set of permanent facilities that meet residents’ vital needs and demands within the residential development area, depends on social and economic factors and so does the notion of quality of built environment itself. What is considered as a “good” environment and “sufficient” fulfillment of vital needs is subjected to change over time, especially in times of increased impact of globalization forces on urban development and security of urban spaces.

Major transformations in definition of comprehensive development are demonstrated in research [1-4]. Current trends include prioritizing sociological impact of comprehensive development over construction aspects, since housing provision meets greater parts of demand both in quality and in quantity [2-3]. Comprehensive urban development is seen by researchers not just a construction problem, i.e. coordinated effort to develop public amenities in the pace that is similar to the residential construction within the same territory [1,3], but also as a sociospatial approach to meeting various vital needs and demands of residents and ensuring pleasant aesthetics [2,3,12-15]. Research demonstrates that the concept of “Smart city” technologies [16-19] slowly becomes an integral part of comprehensive urban development, highlighting the need for digitalization of municipal governance, systemic approach to public amenities provision and constant monitoring of urban development trends in order to eliminate any arising tension.

The goal of this paper is to determine clusters among Russian metropolises according to their rates of social and economic development, measured as rates of investment in comprehensive urban development aimed at meeting vital needs of residents.

3. Data and methods
Conceptually this research relies on works by leading Russian and international scholars in the field of investment n Smart city research [1-7,12-17,19-20]. Authors use statistical database of the Federal State Statistics Service with main indicators of social and economic development of major Russian cities and regions [10]; open data by municipal administrations of major Russian cities on the current state of strategic planning provision [11]. Comparative analysis is conducted via STATISTICA software packages, namely using cluster analysis (agglomerative clustering method), and grouping cities according to rates of investments in comprehensive urban development. Indicators of
comprehensive urban development have been chosen as a result of literature review [12, 19, 21-22] and expert evaluation of indicators favorable living conditions for designing urban development in megacities [20].

4. Research results and discussion

Since researchers have not yet agreed on the main indicators of comprehensive urban development, in this investigation authors will rely on their own conceptual model of comprehensive development that allows them to perform comparative study of different cities. Authors have been developed five hypotheses about comprehensive urban development aimed at integrating theory with available statistical data on meeting the needs of residents:

1. comprehensive urban development is the main indicator of social and economic development of a city and its capacity to meet vital needs of population;
2. hierarchy of vital needs of residents determines the frequency of use, and in turn – demand for public amenities that meet these vital needs;
3. requirements for accessibility for such public amenities determine their place in spatial structure of urban space;
4. globalization forces pressure almost all cities to provide high standards of living, thus making comprehensive urban development a global trend;
5. urban development is uneven in its core, and it is necessary to close the gap in quality of life and vital needs satisfaction between first-tier global cities and peripheral cities by investing in comprehensive urban development.

Based on these hypotheses, Author has analyzed differentiation of Russian megacities by the level of investment activity in comprehensive urban development.

According to the results obtained in the analysis of life quality indicators [12], principles of Smart city modeling [16-19], the results of expert and analytical evaluation of indicators of favorable living conditions and their availability for the population [20-22], priority for integrated development of social infrastructure facilities that provide the reference needs of the population in close proximity to housing. The following indicators have been selected for the study of Russian megacities in terms of investment activity in comprehensive development:

- volume of work performed by the type of activity “Construction” (at actual prices), mln. rubles – \( x_1 \);
- dwellings put in place, thou. square meters of total floor space of dwellings – \( x_2 \);
- general educational schools put in place, pupil places – \( x_3 \);
- pre-school educational institutions put in place, places – \( x_4 \);
- polyclinics put in place, thou. visits per shift – \( x_5 \).

The research has four stages:

1. Grouping megacities in dwellings put in place for the period 2005-2016.
2. Grouping megacities in social infrastructure put in place (general educational schools, pre-school educational institutions, polyclinics), providing the minimum volume of reference needs of the population and forming comprehensive development, for the period 2005-2016.
3. Grouping megacities in volume of work performed by the type of activity “Construction” for the period 2005-2016.
4. The combined cluster analysis of investment activity in comprehensive urban development.

The results of cluster analysis of Russian megacities, conducted on the basis of STATISTICA software packages are shown in table 1.
Table 1. Differentiation of Russian megacities according to the results of cluster analysis.

| Cluster | Indicator |
|---------|-----------|
| I       |          |
|         | I St. Petersburg Moscow Moscow Moscow Moscow |
| II      |          |
|         | II Moscow St. Petersburg St. Petersburg Kazan Kazan |
| III     |          |
|         | III Ufa Ufa, Kazan Yekaterinburg Voronezh |
|         | IV Rostov-on-Don, Kazan, Yekaterinburg, Nizhny Novgorod, Chelyabinsk |
|         | V St. Petersburg, Novosibirsk, Rostov-on-Don, Chelyabinsk, Samara, Ufa, Perm, Omsk, Novosibirsk, Krasnoyarsk, Samara |

According to the results of combined cluster analyses of investment activity in comprehensive urban development the megacities have been grouped in 6 clusters (figure 1):

Cluster 1 – Moscow;
Cluster 2 – Ufa and St. Petersburg;
Cluster 3 – Kazan;
Cluster 4 – Yekaterinburg;
Cluster 5 – Novosibirsk;
Cluster 6 – Krasnoyarsk, Rostov-on-Don, Voronezh, Chelyabinsk, Perm, Samara, Nizhny Novgorod, Omsk, Volgograd.
5. Conclusions
The results allow us to conclude that there is a significant differentiation of Russian megacities in terms of investment activity in comprehensive construction.

A significant gap between the “capital” megacities - cities of Federal importance – Moscow and St. Petersburg and the level of investment and construction activity of other Russian megacities remains stable. However Moscow is far superior to St. Petersburg and is the leader in nearly all analyzed indicators.

There is also inequality in the group of “non-capital” megacities: Kazan, Ufa, Yekaterinburg and Voronezh are the leaders. For the rest of the megacities of this group, it is necessary to “equalize” the conditions for increasing investment activity in comprehensive urban development.

References
[1] Baranovskaya N I and Gu F 2013 Trends in the development of comprehensive housing and civil construction in Russia Bulletin of civil engineers 2 (37) 191–196
[2] Nurullina E I 2014 Consideration of the concepts and essence of comprehensive residential development of the city as a factor in the formation of a qualitatively new living environment Russian business 19(265) 168–177
[3] Ershova S A 2017 Comprehensive residential development: essence and trends Bulletin of civil engineers 1(60) 294–302
[4] Zharova Zh A 2016 Housing construction and prospects of its development in the conditions of non-optimal Russian economy Region economy: theory and practice 1(424) 182–190
[5] Khalezov A S 2007 Point and comprehensive development of Moscow: development trends *Region economy: theory and practice* 14(53) 120–124

[6] Zubarevich N V and Safronov S G 2013 Inequality of socio-economic development of regions and cities of Russia in the 2000s: growth or decline? *J. Soc. sciences and mod. times* 6 15–26

[7] Vendina O 2006 Development strategies of the largest cities of Russia: search for conceptual solutions *Demoscope Weekly. Electronic version of the Bulletin “Population and Society”* 247-248 http://www.demoscope.ru/weekly/2006/0247/analit01.php

[8] The struggle for the citizen: Human potential and urban environment Available at: 2016.mosurbanforum.ru/files/pdf/analiticheskie_obzory/issledovanie_gorodov.pdf

[9] Planning for sustainable cities: strategy directions *Global report on human settlements 2009. Abridged version. UN-HABITAT United Nations human settlements programme* https://www.unhabitat.org/grhs/2009

[10] Websites of Municipal Administration https://www.gov.spb.ru; https://нижнийновгород.рф; https://www.mos.ru; https://www.kzn.ru; http://www.ekburg.ru; http://www.voronezh-city.ru; http://samadm.ru; http://rostov-gorod.ru; http://novosibirsk.ru; https://ufacity.info; https://cheladmin.ru; http://admomsk.ru; http://gorodperm.ru; http://www.admkrsk.ru; http://www.volgadmin.ru

[11] Database of municipal indicators http://www.gks.ru/dbscripts/munst/

[12] Tyulicheva L D 2007 The use of comparative studies to determine the strategic priorities of regional development ed S V Kuznetsov (St. Petersburg: GUAP) p 263

[13] Animitsa E G and Vlasova N Yu 2010 The human factor in the development of major cities *Upravlenets* 7-8(11-12) 13–15

[14] Animitsa E G 2010 Economic growth in the discourse of the space-time paradigm *Region economy* 2 24–28

[15] Ivanov S A and Lozhko V V 2015 On the spatial approach in the theory of regional economy *Bulletin of The SUSU. Series “Economics and management”* 9(1) 18–25

[16] Kupriyanovskij V P, Bulancha S A, Kononov V V, Chernikh K Yu, Namiot D E and Dobrinin A P 2016 Smart cities as “capitals” of the digital economy *International Journal of Open Information Technologies* 4(2) 41–52

[17] Drozhzhinov V I, Kupriyanovskij V P, Namiot D E, Sinyagov S A and Haritonov A A 2017 Smart cities: models, tools, rankings and standards *International Journal of Open Information Technologies* 5(3) 19–48

[18] Seven steps to a smarter city and the imperative to take them https://theurbantechnologist.com/sevensteps-to-a-smarter-city/

[19] Batty M 2007 Model Cities *Working Papers Series* 113 p 37 https://www.bartlett.ucl.ac.uk/casa/publications/working-paper-113

[20] Ershova S A 2014 Standards of urban design. The Experience of St. Petersburg (St. Petersburg: Piter.ru) p 486

[21] Pertsik E N and Kabakova S I 2015 Formation features of spatial urbanization structure in the countries of America in the context of urbanization problems in Russia *Biosphere compatibility: people, region, technologies* 1(9) 52–62

[22] Spatial development of the macro-region economy (by the example of the North-Western Federal district) 2013 ed S V Kuznetsov (St. Petersburg: GUAP) p 333