

Artículo de investigación

## Measuring sustainable cities in Russia: critical analysis of key methodologies

Medición de ciudades sostenibles en Rusia: análisis crítico de metodologías clave  
Medindo cidades sustentáveis na Rússia: análise crítica de metodologias-chave

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### Abstract

The paper provides insights on the critical analysis of the current methodologies of the sustainability cities measurement for the present-day Russia. Based on meta-analysis of more than 90 peer-reviewed papers published in Russian and English, we examined both authoring and corporate methodologies such as the SGM methodology for Russian sustainable cities, the environmental rating of Russian cities, and the rating of the environmental governance of the Russian cities, the environmental efficacy index and several authoring methodologies. The analysis showed that most of the calculation methods are based on quantitative (statistical) data, what is their advantage, on the one hand, making their results as objective as possible, but on the other hand, it is a disadvantage, because in connection with the delay in publication of statistics or even its absence, it does not allow the annual dynamics to observe. In addition, the difficulty in choosing the most suitable methodology lies in the significant differences in the development of large, medium and small cities in Russia, and many rating methods are developed exclusively for one of the types of cities. Authors concluded that in spite of the high level of the existing methodologies development, there was a shortage of comprehensive studies carried out in the qualitative-quantitative paradigm that would, in addition to index assessment and mathematical models generation, explain complex causal relationships and processes within a city.

**Key words:** sustainable cities, measurements, sustainable city methodologies, sustainable city

### Resumen

El documento proporciona información sobre el análisis crítico de las metodologías actuales de la medición de ciudades de sostenibilidad para la Rusia actual. Con base en el metanálisis de más de 90 artículos revisados por pares publicados en ruso e inglés, examinamos tanto las metodologías de autoría y corporativas como la metodología SGM para ciudades sostenibles rusas, la calificación ambiental de las ciudades rusas y la calificación de la gobernanza ambiental de las ciudades rusas, el índice de eficacia ambiental y varias metodologías de autoría. El análisis mostró que la mayoría de los métodos de cálculo se basan en datos cuantitativos (estadísticos), lo que es su ventaja, por un lado, hacer que sus resultados sean lo más objetivos posible, pero por otro lado, es una desventaja, porque en conexión con el retraso en la publicación de las estadísticas o incluso su ausencia, no permite observar la dinámica anual. Además, la dificultad de elegir la metodología más adecuada radica en las diferencias significativas en el desarrollo de ciudades grandes, medianas y pequeñas en Rusia, y muchos métodos de calificación se desarrollan exclusivamente para uno de los tipos de ciudades. Los autores concluyeron que, a pesar del alto nivel de desarrollo de las metodologías existentes, había una escasez de estudios exhaustivos llevados a cabo en el paradigma cualitativo-cuantitativo que, además de la evaluación del índice y la generación de modelos matemáticos, explicaran relaciones y procesos causales complejos dentro de una ciudad.

Palabras clave: ciudades sostenibles, mediciones, metodologías de ciudades sostenibles,

indicators, Russia, Global South, Global North, metabolism

indicadores de cidades sustentáveis, Rússia, Global South, Global North, metabolismo

## Resumo

O artigo fornece insights sobre a análise crítica das metodologias atuais da medição das cidades de sustentabilidade para a Rússia atual. Com base na meta-análise de mais de 90 artigos revisados por pares publicados em russo e inglês, examinamos metodologias de autoria e corporativas, como a metodologia SGM para cidades russas sustentáveis, a classificação ambiental de cidades russas e a classificação da governança ambiental das cidades russas, o índice de eficácia ambiental e várias metodologias de autoria. A análise mostrou que a maioria dos métodos de cálculo são baseados em dados quantitativos (estatísticos), o que é sua vantagem, por um lado, tornando seus resultados tão objetivos quanto possível, mas, por outro lado, é uma desvantagem, porque em com o atraso na publicação das estatísticas ou mesmo sua ausência, não permite que a dinâmica anual observe. Além disso, a dificuldade em escolher a metodologia mais adequada reside nas diferenças significativas no desenvolvimento de grandes, médias e pequenas cidades na Rússia, e muitos métodos de classificação são desenvolvidos exclusivamente para um dos tipos de cidades. Os autores concluíram que, apesar do alto nível de desenvolvimento das metodologias existentes, houve escassez de estudos abrangentes realizados no paradigma qualitativo-quantitativo que, além da avaliação de índices e da geração de modelos matemáticos, explicariam relações e processos causais complexos Uma cidade.

**Palavras-chave:** cidades sustentáveis, medidas, metodologias de cidades sustentáveis, indicadores de cidades sustentáveis, Rússia, Sul Global, Norte Global, metabolismo

## Introduction

Despite the fact that only 50% of the world's population lives in cities, according to the various studies they consume 75% of the world's generated energy and produce up to 80% of greenhouse gas emissions (Climate change and urbanization, 2008). In turn, anthropogenic impact on the environment is increasing resulting in pollution and accelerated degradation of natural environments, depletion of natural resources, climate change, decrease in biodiversity, and so on. All of this, on the one hand, leads to a deterioration of health and life quality of citizens, and, on the other hand, constrains the possibilities of further city development.

The hypertrophied example of the entire spectrum of city's adverse impact is a megacity. And Russia is not an exception. That is why, today, one of the main Russia's social and environmental challenges is a search for the balance between economic growth and preservation of environmental quality, that is, sustainable ecological development of urban systems without losses in economic, technological, and social sectors. Russian scientists have been engaged in the search for

such a balance for more than a century (Yanitsky & Usacheva, 2017; Usacheva, 2017).

Nowadays, there are many social and economic methods to assess these factors. The main ones are the McKinsey Index on Sustainability & Resource Productivity (McKinsey on Sustainability & Resource Productivity, 2012), the European Green City Index (European Green City Index, Economist Intelligence Unit, 2009), the Urban Sustainability Index in China calculated by the joint initiative of Columbia University, Qinhua University and McKinsey Company (The Urban Sustainability Index, 2010), World City Ranking by the Life Quality Level (Economist Intelligence Unit, 2016), the Environmental Performance Index (Environmental Performance Index, 2016). Also known are the society sustainability indices including environmental sustainability indices: the Social Progress Index (The Social Progress Index, 2016), the Sustainable Society Index (Sustainable Society Index), the Human Development Index compiled by the United Nations Development Program (Human Development Index), etc. (Ermolaeva, 2017).

However, most of the abovementioned methodologies are measuring the levels of cities sustainability in the Global North, while very few of them incorporate indicators relevant to the social, economic and environmental landscapes of developing countries. The intent of this paper is to critically analyze methodologies of the sustainability cities measurement for the developing countries context based on the present-day Russian case.

The research objectives are: first, to critically analyze the current methodologies for measuring the level of Russian cities sustainability that are based on the triple line approach; second – to reveal the advantages and shortcomings of the each methodology, and finally, to provide suggestions on how to potentially advance the current methodologies in regard to measuring city sustainability. With these in mind, this contribution seeks to work towards a better understanding of the current methodologies employed to analyze city sustainability, their advantages and limitations taking into account the current context of Global South and based on the post-socialist Russia context.

#### **Methods of research**

The main method of research was the meta-analysis of peer-reviewed papers published in Russian and English. The authors selected the papers by keywords: “sustainable city indicators”, “measurements for the sustainable cities”, “sustainable city methodologies”, “sustainable city indexes”, etc. A total of more than 90 papers were analyzed in the period from 2000 to the present days. The meta-analysis was conducted in March 2018. The research was implemented under Russian Science Foundation grant “Russian megacities in the context of new social and environmental challenges: interdisciplinary building complex model for an assessment of 'green' cities and strategies for their development in Russia”, project No. 17-78-20106.

#### **Results and discussions**

The analysis showed that among the authoring methodologies for assessment of the sustainability of cities, it is possible to single out the works of P.A. Korotkov, L.N. Medvedeva et al., E.A. Tretyakova, S.N. Bobylev, O.V. Kudryavtseva and S.V. Solov'ev (Korotkov & Trubyanov, 2014; Korotkov et al, 2015;

Medvedeva et al, 2015; Tretyakova, 2014; Bobylev, 2007; Bobylev et al, 2014).

The most comprehensive study on the topic "Evaluation of the environmental performance of large cities of developing countries in the context of rapid urbanization" was held in 2008-2011 under the leadership of Korotkov P.A. Korotkov's team emphasized the need to search for models that provide economic growth while reducing damage to the environment and natural resources. By the example of major administrative centers in the constituent subjects of the Russian Federation, a methodology for the quantitative assessment of the environmental efficiency of cities was developed and tested, and as a result of its application, a rating of Russian cities was obtained. The methodology is designed exclusively for large cities and depends on the availability of full official statistical information, often inaccessible to a number of cities.

Also interesting is the study of L.N. Medvedeva and her colleagues, who proposed a conceptual and methodological justification for the strategy of forming "green" cities on the basis of medium-sized industrialized cities of Russia and their effective use of environmental, institutional, material, information, humanitarian and financial resources. Scientists have identified the factors that affect the conditions and trajectory of development of a medium city (organizational, managerial, technical and technological, infrastructure, environmental, tourism and recreational, information and communication, and social factors); they also proposed a methodology for calculating the integral indicator of the development potential of a medium city for promoting "green" technologies. This indicator includes an assessment of industrial production, infrastructural, financial and human potential. The advantage of this methodology is that it has practical access to the strategy concept for development of "green cities" based on the effective use of resources, but it is designed exclusively for medium-sized industrial cities in Russia.

Russian scientists [17] proposed to adapt to the Russian realities the urban sustainability indicators based on the human development index developed by the United Nations Development Program and the adjusted net savings index of the World Bank. In order to assess the urban development sustainability taking into account economic, social and

environmental factors, the authors propose to single out three corresponding sub-indices: gross fixed capital formation, expenditures on human capital development, and damage from environmental pollution in cities. According to the authors, for Russian cities this system of indicators reflects the most urgent problems of sustainable development and the quality of life of their citizens, and is also adequate to the capabilities of Russian statistics. The indicators are divided into nine groups: economic indicators, energy efficiency, transport, social and institutional indicators, air and climate, water resources, waste, specially protected natural areas, and noise impact.

Being an integral evaluation of the social and economic components of the life quality in cities, the human development index can be the one calculated on the basis of three indicators: longevity measured as the life expectancy at birth; achieved educational level; the standard of living measured on the basis of GDP per capita based on purchasing power parity. An indicator of solid suspended particle emissions with a diameter of less than 10 microns can be chosen in the capacity of an indicator for assessing the ecological component of the life quality in cities and the sustainability of their development. Possibility of adaptation of the methodology to Russian realities is its undisputed advantage. It reflects the most urgent problems of the development of Russian cities and the quality of life of citizens and is adequate to the possibilities of Russian statistics.

There are also a number of corporate methods for assessing the sustainability of Russian cities. One of the most popular is the method of sustainable development assessment for Russian cities implemented by SGM agency (Rating of sustainable development of Russian cities for 2013). The rating was compiled for the first time in 2012 in accordance with the principles of sustainable development of a territory defined by international organizations and the scientific community. The rating covered 173 cities of the Russian Federation with a population of more than 100 thousand people each. The life quality with regard to the triune outcome concept was determined by a large set of indicators, including economic development, which is the driver of growth of modern cities, where industrial production and services are concentrated, monetary and tax flows, and also incomes of the population and municipalities are formed. The

state of the urban environment and infrastructure, both social and communal, determines the assessment of the life quality conditions of the population. Ecological parameters take into account the comfort of living of the population and the degree of anthropogenic pressure on the environment. In total, the integral indicator uses 31 indices. The advantages of the rating are that its indicators are formulated to establish development guidelines for various stakeholders (regional authorities, residents, investors) for comparative analysis. The limitation of the method is that cities with a population of more than 100 thousand people located in 80 regions of the Federation are considered, but cities with a smaller population which significance could also be important for the rating, are not considered.

The environmental management rating of Russian cities is annually prepared by the subordinate institutions under the Ministry of Natural Resources of the Russian Federation with the methodological support of the British audit and consulting company EY (The rating of environmental management..., 2015). This rating assesses not only and not so much the ecological purity of cities, but also the effectiveness of managing environmental development. The maximum value of the coefficient is "1". The structure of the coefficient consists of seven key categories: the air environment, transport, energy consumption, water use, waste management, the biotic environment (flora and fauna), and management of the environmental impact.

In the autumn of 2017, experts from the All-Russian People's Front jointly with the Ministry of Natural Resources of Russia prepared another project "Ecological rating of Russian cities - 2017" on the basis of data submitted by the authorities of large municipal entities on the territory of all regions of the country (Rating of ecological development of Russian cities in 2017). The rating is compiled annually from 2013 in order to assess the adequacy of the municipal authorities' efforts to ensure a favorable environment and a high quality of life for citizens, and to prepare proposals for improving the ecology and habitat of citizens that the city authorities will be able to apply in practice. The specificity of this rating is that, in addition to quantitative data provided by officials, expert and public opinion was taken into account to obtain a true picture. The problem of rating is still the assessment of the reliability of

the data provided and their completeness, since the management of many cities does not provide comprehensive information about their ecological state.

The environmental rating of the constituent entities of the Russian Federation was compiled by the environmental non-profit organization "Green Patrol" (Ecological rating of subjects of the Russian Federation: Ideology, conceptual model and methodology of rating calculation). The ideology of the rating is formed taking into account the principles of sustainable development; its purpose is to implement public monitoring and a comparative assessment of the regions of the Russian Federation in the sphere of environmental safety and protection. The rating is calculated on-line. Significant events are recorded in the database of the information and analytical system. Each subject has a "Chronicle of events", where these significant events are reflected. The group of experts submits assessments to the event in three spheres: the ecosphere (environmental index), the technosphere (industrial-ecological index), and society (socio-ecological index). Each index has seven indicators, and depending on the nature of the event, and numerical values  $+1$  /  $-1$  are assigned to a certain indicator or several indicators, where  $+1$  is a positive estimate, and  $-1$  is negative. In total, the indicator for ecological themes includes 21 indicators. The advantage of the rating is that it is based not only on static data, but also involves the assessment of the local active population, and registers incidents on-line, what makes it unique for multi-level analysis. The drawbacks of the rating are that its results are relative and depend on the performance of all the participants in the rating for the reporting period. Thus, the positions in the rating of a specific region in different periods may differ with the invariance of its indicators due to changes in the indicators of other regions.

The rating of ecological efficiency of Russian cities includes 19 indicators. They are divided into groups: environmental health, ecosystem viability, and include categories: health effects, air pollution, health effects, water and sanitation, climate change and energy, water resources (ecosystem effects), biodiversity, agriculture, forest, fishing (The ecological efficiency rating... 2014).

## Conclusion

The paper provides critical analysis of the key methodologies for measurement of Russian

sustainable cities including the SGM methodology for Russian sustainable cities, Environmental rating of the Russian cities, rating of the environmental governance of the Russian cities, environmental performance index, and several authors' methodologies.

Most of the environmental ratings considered by us assess the Russian cities in three generalized indicators - social, economic and environmental, which correspond to the principles of the "triune total". All methods of calculation, with the exception of the "Green Patrol" technique, are based on quantitative (statistical) data, what on the one hand is their advantage, making their results as objective as possible, but on the other hand, it is a disadvantage, because of the delay in publication of statistics or even its absence; it also does not allow to observe the annual dynamics. In addition, the difficulty in choosing the most suitable methodology lies in the significant differences in the development of large, medium and small cities in Russia: many rating methods are developed exclusively for one of the types of cities.

Stressing on the high level of existing foreign and Russian works on assessing the sustainability of cities, we notice that there is a shortage of comprehensive studies carried out in a qualitative-quantitative paradigm and would, in addition to index assessment and mathematical models generation, explain complex causal relationships and processes within a city, as well as to determine the extent of social policy formation. In addition, the limitation of these methods is the impossibility of tracking the dynamics of the development of the sustainable cities in time. Today, both technology and human needs and attitudes are developing so rapidly and controversially that theoretically the best "indicator" is monitoring, that is, continuous monitoring of the agent of interest to us or its habitat. Three things are important here. First, this monitoring should be multidimensional, that is, interdisciplinary, because "everything is connected with everything, everything gets somewhere, and nothing is given for nothing" (B. Commoner). Second, these interconnected indicators can record different speeds (more precisely, tempo-rhythms) of individual agents of a particular bundle. Thirdly, in the course of their nonlinear dynamics, these different, but interrelated agents change each other. That is, our analysis of sustainability of Russian cities should be not only multidimensional, but also metabolic.

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### Bibliography

Climate change and urbanization: effects and implications for urban governance. International Institute for Environment and Development, UK, 2008.

Yanitsky, O., & Usacheva, O. (2017). History of the "Green City" in Russia. *Journal of History of Culture and Art Research*, 6 (6), 125-131.

Usacheva (Basheva) O.A. (2017). Russian Concepts of Greening Cities / Russia and the World: Global Challenges and Strategies for Sociocultural Modernization. Materials of the International Scientific and Practical Conference (Moscow, October 12-13, 2017) / Executive editor A.V. Tikhonov. Moscow: FNISTS RAS, 2017. Pp. 726-732.

McKinsey on Sustainability & Resource Productivity, 2012 [Electronic resource] URL: [https://www.mckinsey.com/client\\_service/sustainability/latest\\_thinking/~media/5E14ED58049D44148B5A47C0124A7E66.ashx](https://www.mckinsey.com/client_service/sustainability/latest_thinking/~media/5E14ED58049D44148B5A47C0124A7E66.ashx)

European Green City Index, Economist Intelligence Unit, 2009 [Electronic resource] URL:

[https://www.siemens.com/entry/cc/features/greencityindex\\_international/all/en/pdf/report\\_en.pdf](https://www.siemens.com/entry/cc/features/greencityindex_international/all/en/pdf/report_en.pdf)

The Urban Sustainability Index, 2010 [Electronic resource] URL:

<http://www.urbanchinainitiative.org/en/research/usi.html>

Economist Intelligence Unit, 2016 [Electronic resource] URL:

<https://www.economist.com/blogs/graphicdetail/2016/08/daily-chart-14>

Environmental Performance Index, 2016 [Electronic resource] URL:

<https://epi.envirocenter.yale.edu/>

The Social Progress Index, 2016 [Electronic resource] URL:

<http://www.socialprogressimperative.org/publication/2016-social-progress-index/>

Sustainable Society Index [Electronic resource] URL: <http://www.ssindex.com/>

Human Development Index [Electronic resource] URL:

<http://hdr.undp.org/en/content/human-development-index-hdi>

Ermolaeva P.O. (2017). In the labyrinths of the «sustainable city» concepts: the meta-analysis of contemporary studies. *The Turkish Online Journal of Design, Art and Communication*.

Korotkov P.A., Trubyanov A.B. (2014). Estimation of ecological efficiency of large cities in the conditions of rapid urbanization // *Scientific journal of KubSAU*. №102 (08). P.1-27.

Korotkov P.A., Trubyanov A.B., Zagainova E.A., Nikonorov K.N. (2015). Analysis of the sustainability assessments on the ecological efficiency of large cities // *Economic sciences*. №111. P.793-797.

Medvedeva L.N., Kozenko K.Yu., Komarova O.P. (2015). Prospects of medium-sized cities in the development of green economy // *News of the complex of Nizhnevolsky Agrarian University: science and higher professional education*. №4 (40). P.214-221.

Tretyakova E.A. (2014). Development sustainability assessment of ecological and economic systems: a dynamic method // *Prediction problems*. No. 4 (145). Pp. 143-154.

Bobylev S.N. (2007). Indicators of sustainable development: a regional dimension. A handbook on regional environmental policy. - M.: Acropolis, CEPR, 60 p.

Bobylev S.N., Kudryavtseva O.V., Solovyeva S.V. (2014). Indicators of sustainable development for cities // *Economy of the region*. No. 3. Pp. 101-110.

Rating of sustainable development of Russian cities for 2013 / LLC "Agency ES GM" [Electronic resource]. URL:

<http://agencysgm.com/projects/SGM%20Rating2013.pdf>

The rating of environmental management..., 2015 / LLC "Agency ES GM" [Electronic resource]. URL:

<http://agencysgm.com/news/rejting-ekologicheskogo-upravleniya-gorodov-rossii/> Rating of ecological development of Russian cities in 2017 [Electronic resource]. URL: [https://onf.ru/sites/default/files/projects\\_docs/2112017.pdf](https://onf.ru/sites/default/files/projects_docs/2112017.pdf)

Ecological rating of subjects of the Russian Federation: Ideology, conceptual model and methodology of rating calculation [Electronic resource]. URL:

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resource].URL:  
[http://greenpatrol.ru/sites/default/files/\\_ppt\\_1\\_0\\_0.pdf](http://greenpatrol.ru/sites/default/files/_ppt_1_0_0.pdf)

The ecological efficiency rating... 2014  
[Electronic resource].URL:  
<https://epi.envirocenter.yale.edu/>