

## ARTICLE

# EVALUATION OF URBAN LIVEABILITY IN MAJOR CITIES OF RUSSIA

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## ABSTRACT

The urban live ability of city area creates the conditions for a healthy, comfortable and convenient human life. The higher the livability of the city, the higher the likelihood of urban improving the city appearance, which in turn maintains a stable socio-economic situation and increases the investment and tourist attractiveness of the city. In order to evaluate urban livability in Russian cities the authors collected a database consisting of 13 indicators over a period of five years (2013-2017). Based on the integral index of urban livability, the following groups of Russian cities can be distinguished: cities with a developing level of urban livability (Voronezh, Yekaterinburg, Ufa, Krasnoyarsk), cities with a stable level of urban live ability (Volgograd, Samara, Perm, Nizhny Novgorod), cities with declining level of urban livability (Novosibirsk, Omsk), cities with volatile level of urban live ability (Kazan, Chelyabinsk, Rostov-on-Don). A system update of the information for calculating the index will allow to develop qualified solutions for the development of cities at the federal, regional and municipal levels, to evaluate the effectiveness of programs and projects already being implemented in this area.

## INTRODUCTION

### KEY WORDS

urban development, live ability, evaluation, city, Russia.

The urban live ability of city area creates the conditions for a healthy, comfortable and convenient human life. The higher the livability of the city, the higher the likelihood of urban improving the city appearance, that in turn maintains a stable socio-economic situation and increases the investment and tourist attractiveness of the city.

The relevance of this topic is due to the fact that the majority of the population nowadays is concentrated in cities. Therefore, for their comfortable living it is necessary to ensure a high level of quality of the urban environment. With the active growth of cities, the development of industry, the increasing level of urbanization of the population, the problems of environmental protection and the creation of favorable conditions for human activity are becoming more urgent. To solve these problems, a whole range of activities aimed at improving the urban environment of the city is carried out.

There is a set of papers devoted to measuring the urban live ability in different countries. Adam et al. (2017) studied the global research output on urban live ability over the period of 35 years (1980-2015). The results revealed that live ability research output is steadily increasing, with 2015 as the most prolific year. Australia, England, and the USA are the most productive countries. While continuous research interest is prevalent in live ability related field with global collaborative potentials, areas receiving the least research attention such as urban transportation, education, and resiliency could give a directional trend for future urban studies [1].

Among new studies in this field we note Deng et al. (2019) who propose quick assessment for comparing and evaluating the trends of the sustainability performance of the urban built environment to support decision making of urban managers. Their quick assessment can produce a general idea of sustainability profile for the urban built environment, which creates a foundation for further research and planning for improvements by employing more effective measures [2].

Onnom et al. (2018) developed a Livable City Index (LCI) based on residents' opinions and experts' recommendations with the integration of Geographic Information System (GIS) techniques. The survey evaluates nine significant factors (Safety, Economy, Environment, Education, Health, Transportation, Recreation, Population Density, and Public Utility) through the Analytical Hierarchy Process (AHP) for LCI development [3].

Valcárcel-Aguar & Murias (2019) propose a composite indicator intended to assess the degree of liveability provided by urban areas. The technique used to estimate the goal-programming-based index enables urban managers to actively participate in constructing the indicator [4].

The paper of Oppio et al. (2018) brings forward a multidimensional methodology for assessing the quality of open spaces. The Multi-Attribute Value Theory has been used for addressing the problem under investigation with the aim of defining a synthetic index for the measurement of the urban quality of open spaces on the basis of different attributes, namely (a) accessibility; (b) live ability; (c) vitality and (d) identity [5].

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Zope et al. (2019) study the use of benchmarking in performance improvement of the transport system. Results obtained through the study shows that the cities having a better modal share of sustainable modes occupy a higher rank with greater values of the sustainability index. In this study, a software tool for monitoring the sensitivity of composite index of transport system towards performance indicators of sustainability is also developed [6].

## MATERIALS AND METHODS

In order to evaluate the urban liveability of Russian cities the authors collected a database consisting of 13 indicators over a period of five years (2013-2017):

- the share of citizens working in the tertiary sector of the economy, % of the total number of employed;
- the proportion of illuminated parts of streets, driveways, embankments in its total number, %;
- the amount of waste removed per capita, cubic meters / person;
- total number of accidents in the city, units / 10,000 people;
- the number of fatal accidents involving pedestrians, units / 10,000 people;
- share of dilapidated housing, in% of the total area of housing;
- concentration of cultural institutions (libraries, museums, theaters), units / square kilometer of the city square;
- diversity of cultural and leisure activities in the city, units / 10,000 population;
- availability of sports facilities for citizens, units / 10,000 population;
- availability of recreation parks (urban gardens), units / 10,000 people;
- the proportion of roads with improved coverage, in% of the total length;
- the average living space per inhabitant, square meters;
- the average area of dwellings built in the current year per inhabitant, square meters.

The data on these indicators were taken from municipal statistics, the Federal State Statistics Service of the Russian Federation [7-11], the official web portals of cities, as well as from the reports on road traffic safety.

For the possibility of comparing and evaluating indicators, rationing of indicators was applied. If the particular indicator has a positive impact, then equation 1 is used.

$$\bar{X} = \frac{x - x_{\min}}{v - x_{\min}} \quad (1)$$

If the indicator has a negative impact, then equation 2 is used.

$$\bar{X} = 1 - \left| \frac{x - x_{\min}}{v - x_{\min}} \right| \quad (2)$$

where X is the value of the indicator;

x\_max - the maximum value of the indicator;  
 x\_min - the minimum value of the indicator.

Next, we defined the integral index of urban liveability (x\_int) as the sum of private indicators.

$$x_{int} = \sum x_i \quad (3)$$

where x\_i is the value of the i-th indicator.

## RESULTS AND DISCUSSION

According to authors methodology selected indicators were collected for the period 2013-2017 years for all Russian cities with the population more than one million people, excluding Moscow and Saint-Petersburg. These two cities are endowed with the status of a state (region), therefore it is incorrect to use them for comparison with other cities which are municipalities. Further, each indicator was normalized and city ratings were compiled for each year. Further each indicator is considered in more detail.

The first two selected indicators determine the safety of the city. The smallest number of accidents per 10000 inhabitants for the entire research period took place in the cities Yekaterinburg, Samara, Novosibirsk, Voronezh and Volgograd. High rates in these cities are largely due to the successful implementation of urban targeted programs. For example, in Samara for 10 years, the number of accidents decreased by 30% (1225 cases in 2015 against 1612 in 2005). Such cities as Kazan, Rostov-on-Don, Chelyabinsk, Krasnoyarsk are in the middle of the ranking. The main causes of accidents in the city of Kazan are the neglect of road users by the rules, the carelessness of drivers. Cities Nizhny Novgorod, Omsk, Ufa and Perm are at the bottom of the rating for this indicator. The number of fatal accidents involving pedestrians is volatile and varies in all cities during the research period. So, for 2013-

2017, only Novosibirsk, Nizhny Novgorod and Ufa showed the smallest number of deaths of pedestrians on the roads. Yekaterinburg, Voronezh can be distinguished as permanent outsiders.

The cities Chelyabinsk, Kazan, Ufa, Nizhny Novgorod and Voronezh had the best road conditions. In this group the city Ufa made a huge step forward (+5 positions by 2017) due to the project "Safe quality roads". In city Kazan there was a noticeable improvement in road conditions, especially due to the large-scale sporting. The cities Krasnoyarsk, Yekaterinburg, Novosibirsk, Rostov-on-Don, being in the middle of the rating, experienced such problems as insufficient roads repair and disruption in the organization of road works. Over the years, such cities as Perm, Omsk, Samara and Volgograd remain outsiders for the quality of roads. The main reasons for bad roads in these cities are poor quality of coverage and insufficient funding.

Leaders in the smallest share of dilapidated housing are cities Chelyabinsk, Omsk, Rostov-on-Don, Voronezh, Yekaterinburg. The middle group includes cities Kazan, Novosibirsk, Nizhny Novgorod, Perm. The cities Volgograd, Ufa, Samara, Krasnoyarsk are outsiders. According to this indicator, small numbers are observed in all cities - no more than 3% of dilapidated housing from the total area of the housing. Reducing the level of dilapidated housing in these cities was achieved through the implementation of state and municipal programs providing housing for young families, the relocation of citizens from the dilapidated housing and the improvement of utility services.

The cities Voronezh, Rostov-on-Don, Yekaterinburg, Novosibirsk, Kazan and Krasnoyarsk were among the leaders in housing construction. In the cities Ufa, Chelyabinsk, Samara, forming the middle group of the rating, housing construction plans were carried out by 70-80%. The cities Perm, Volgograd, Nizhny Novgorod, Omsk are at the bottom of the rating. In terms of the average living space per inhabitant the leaders are cities Voronezh, Samara, Rostov-on-Don, Chelyabinsk, Kazan. The cities Ekaterinburg, Novosibirsk, Nizhny Novgorod, Omsk, Krasnoyarsk consist the middle group of rating. In the cities Volgograd, Perm and Ufa, which are at the bottom of the rating, the living space ranges from 23 to 28 square meters per inhabitant. High results for this indicator are due to the construction pace, the new housing construction, the availability of housing loans.

Leaders in the concentration of cultural institutions are cities Nizhny Novgorod, Novosibirsk, Voronezh, Krasnoyarsk, Rostov-on-Don. The successful experience of these cities is based on the historical past and the diversity of traditions. In addition, these cities often use the cultural component in the positioning of the city. The middle group of rating consists of such cities as Samara, Kazan, Yekaterinburg, Chelyabinsk. Here, in general, the branch of culture works stably. Outsiders of the rating are the cities Omsk, Ufa, Volgograd and Perm.

Leaders in the share of citizens working in the tertiary sector of the economy are cities Rostov-on-Don, Yekaterinburg, Volgograd, Samara, Nizhny Novgorod. Since the founding of Rostov-on-Don, the main branch of the economy has been trade, and the city itself has been called merchant. The success of city Yekaterinburg partially connected with the largest decline (from 46 percent to 20 percent) occurred in the industrial sector in 2016. The cities Krasnoyarsk, Voronezh, Ufa, Kazan are in the middle group, because the industrial sector plays a significant role in the economy of these cities. The cities Novosibirsk, Chelyabinsk, Omsk, Perm are at the bottom of the rating.

Cities, leading in cultural and leisure activities, are Krasnoyarsk, Ufa, Volgograd, Voronezh, Perm. Cities Omsk, Novosibirsk, Yekaterinburg, Rostov-on-Don are in the middle group. The reduction of cultural and leisure activities in observed in such cities as Chelyabinsk, Kazan, Nizhny Novgorod, Samara. The availability of sports facilities has high rates in such cities as Krasnoyarsk, Ufa, Chelyabinsk, Omsk, Rostov-on-Don. Average indicators are typical for cities Kazan, Nizhny Novgorod, Voronezh and Yekaterinburg. In 2015, 18 universal sports grounds were built in Kazan in residential courtyards (15 in 2017). In Yekaterinburg, most of the sports infrastructure is concentrated in a central area with maximum economic benefits, while some neighborhoods do not have a single sports facility at all. The cities with the lowest indicators are Perm, Volgograd, Samara and Novosibirsk.

Leaders in terms of the availability of recreation parks are cities Kazan, Voronezh, Nizhny Novgorod, Samara and Rostov-on-Don. In 2014-2016, five main parks were renovated in Kazan. In 2017, in Voronezh, many parks were landscaped and new green areas for recreation were opened. The middle group of rating includes cities Ufa, Volgograd, Perm and Novosibirsk. Cities Krasnoyarsk, Chelyabinsk, Omsk and Yekaterinburg are outsiders of this rating.

The leaders in road illumination are the cities of Ufa, Rostov-on-Don, Voronezh, Chelyabinsk and Nizhny Novgorod. The middle group is represented by the cities of Kazan, Krasnoyarsk, Samara and Volgograd. Improving street lighting in Kazan is due to the introduction of an automated control system for outdoor lighting, the installation of LED lights. The cities Perm, Yekaterinburg, Omsk and Novosibirsk had the lowest level of road illumination. In Novosibirsk, it is due to the optimization of the street lighting work schedule due to the lack of funding. The situation is similar in Omsk.

Leading cities by the smallest amount of waste are Yekaterinburg, Omsk, Chelyabinsk, Voronezh and Perm. It should be noted that the reduction in the volume of garbage collection may be due to the occurrence of unauthorized landfills, and therefore it is necessary to check the routes of waste removal.

The middle group of rating includes cities Kazan, Nizhny Novgorod, Krasnoyarsk and Samara. In Kazan and Nizhny Novgorod projects of separate waste collection developed poorly. The cities Ufa, Novosibirsk, Volgograd and Rostov-on-Don have the highest level of this indicator. In these cities, the amount of waste increased annually and unauthorized dumps remained relevant.

After calculating private indicators, the integral urban live ability index was evaluated. The results are presented in a [Table 1].

**Table 1:** Rating of cities by the according to the integral urban live ability index

	2013		2014		2015		2016		2017	
	Index	Rating	Index	Rating	Index	Rating	Index	Rating	Index	Rating
Novosibirsk	7.4	4	8.3	1	5.9	8	5.2	9	5.3	9
Ekaterinburg	6.8	6	7.1	5	7.1	3	6.8	4	7	4
Nizhny Novgorod	6.4	7	6.1	7	5.5	9	6.1	8	6.1	8
Kazan	8.5	1	7.2	4	6.8	5	7.5	2	7.3	2
Chelyabinsk	7.3	5	7	6	7	4	7.4	3	6.7	5
Omsk	5	11	4.8	10	4.2	11	4.8	11	3.7	13
Samara	5.4	9	4.6	11	4.7	10	4.9	10	5.1	10
Rostov-on-Don	8	2	7.5	3	7.6	2	7	5	7.1	3
Ufa	5.4	10	5.8	8	6.5	6	6.3	7	6.3	7
Krasnoyarsk	5.7	8	5.3	9	6.1	7	6.3	6	6.5	6
Perm	3.8	13	2.5	13	3.5	13	3.4	12	4.1	12
Voronezh	85	3	8.2	2	8.3	1	8.2	1	7.9	1
Volgograd	4.4	12	4.5	12	3.7	12	3.3	13	4.5	11

Thus, the evaluation of urban live ability indicator determines the current state of city. And private indicators can help to identify the advantages, disadvantages and current problems of cities. A system update of the information for calculating the index will allow to develop qualified solutions for the development of cities at the federal, regional and municipal levels, to evaluate the effectiveness of programs and projects already being implemented in this area.

Based on the integral index of urban live ability, the following groups of Russian cities can be distinguished:

- cities with a developing level of urban live ability: Voronezh, Yekaterinburg, Ufa, Krasnoyarsk;
- cities with a stable level of urban live ability: Volgograd, Samara, Perm, Nizhny Novgorod;
- cities with declining level of urban live ability: Novosibirsk, Omsk;
- cities with volatile level of urban live ability: Kazan, Chelyabinsk, Rostov-on-Don.

## CONCLUSIONS

The analysis of Russian cities with more than million populations according to our methodology allowed us to reveal their problems and opportunities in urban live ability. For example, city Novosibirsk has low rates in the housing and transport sector, and there are also problems in the accessibility of sports fields, parks of culture and recreation. As for the city Nizhny Novgorod, there is low road safety, low provision of housing and sports facilities, lack of diversity of cultural and leisure organizations, as well as a growing amount of garbage. According to our research, the city Chelyabinsk has the best results in the proportion of roads with improved coverage. There is a low proportion of dilapidated housing, high accessibility of sports grounds, recreation parks and the necessary lighting of streets and embankments in this city. The city Rostov-on-Don has good results in the housing sector, the largest share of those employed in the services sector, adequate coverage of streets and embankments. Finally, the city Voronezh leads in housing, in the city high availability of cultural facilities, recreation parks, and a variety of cultural and leisure facilities for residents.

**CONFLICT OF INTEREST**

There is no conflict of interest.

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