Territorial Assessment of the Infrastructure in Rural Areas of the Republic of Bashkortostan

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Abstract. This paper presents integral assessment of the territorial infrastructural conditions in rural areas, which is based on aggregating the performance metrics of sociocultural infrastructures and public utilities. Sociocultural infrastructure assessment took into account the availability of schooling for children, inpatient hospital beds, doctors and nurses, as well as seats in cultural venues per person. Public utilities were assessed in terms of housing conditions, while the state of local roads was assessed in terms of road-grid density, the length percentage of hard-paved roads, and the length percentage of standard-compliant local roads. The authors hereof group the municipalities in the Republic of Bashkortostan by their infrastructural conditions and outline the priorities of such development for different rural areas.

1. Introduction
Socioeconomics is the single most important aspect of living standards in rural areas. Years of ‘reforms’ have deprived many areas of healthcare facilities, schools, and libraries. As of today, many rural areas are inferior to cities in terms of living standards; their residents have limited access to social institutions. Social infrastructures, roads, and public utilities tend to be far better developed in municipality centers and larger settlements. Consider the state-of-the-art of these infrastructures in rural areas.

2. Problem statement
Social conditions are a factor of regional reproductive potential; they manifest in the functioning of sociocultural infrastructures and public utilities. Infrastructural conditions can be assessed by a variety of metrics; however, the best option is to use key metrics that are most indicative of the socioeconomic development of rural areas in its various aspects. Social infrastructure metrics are: the availability of preschool education to children aged 1 to 6 (number of kindergartens per 1,000 children), the number of hospital beds per 10,000 people, the number of doctors per 10,000 people, the manpower of nursing staff per 10,000 people, the number of seats at cultural venues per 1,000 people. Public utilities are assessed in terms of housing amenities, i.e. as the percentage of apartments with access to electricity, running water, sewerage, etc. The state of local roads is assessed in terms of road-grid density, the length percentage of hard-paved roads, and the length percentage of standard-compliant local roads.

3. Research questions
The main research objectives were to:
1. Identify key metrics most indicative of infrastructural conditions in rural areas;
2. Apply integral assessment by metric aggregation;
3. Group the Republic of Bashkortostan’s municipalities by their infrastructural conditions;
4. Outline the priorities for the infrastructure development in rural areas.

4. Purpose of the study
To assess the infrastructural conditions of rural areas in the Republic of Bashkortostan on a territorial basis

5. Research methods
The metrics were chosen with the following in mind: availability of statistics (all the data used in this research effort were found on the official websites and databases of Rosstat, as well as on the departmental websites), completeness of data (data sets used covered all the municipalities in the Republic), and relevance of metrics (the metrics had to relate directly to the socioeconomic conditions of rural areas).

Relative metrics were applied to each infrastructure component. Partial maxima and minima of the metrics were then applied to compute partial scores in demographic development, infrastructural conditions, and agricultural state-of-the-art of the rural areas. Scores were calculated by the formula:

\[ b_{ij} = \frac{x_{ij} - x_{j \text{ min}}}{x_{j \text{ max}} - x_{j \text{ min}}} \]

where \( b_{ij} \) is the score of the ith metric for the jth municipality;
\( x_{ij} \) is the value of the ith metric for the jth municipality;
\( x_{i \text{ min}} \) is the minimum value of the ith metric for the jth municipality;
\( x_{i \text{ max}} \) is the maximum value of the ith metric for the jth municipality.

From the obtained values of the ith metric for the jth municipality, calculate the mean for each municipality and group them by the mean integral score.

Grouping as a statistical analysis tool helped generate a breakdown of the municipalities by the metrics, identify patterns in the distribution of socioeconomic processes and phenomena, track their quantitative changes, and evaluate the developmental inequality of municipalities.

6. Findings
The novelty of this research lies in:
1. identifying the key traits of rural infrastructures in the region;
2. substantiating a reproduction-based approach to infrastructural assessment;
3. proposing an integral assessment of infrastructural conditions by metric aggregation;
4. grouping the Republic of Bashkortostan’s municipalities by their infrastructural conditions;
5. outlining the priorities for the infrastructure development in rural areas;
6. substantiating governmental intervention for sustainable development of infrastructures in rural areas.

Across the Russian Federation, social infrastructures are in decline in rural areas, see Table 1. This happens due to physical wear and tear, closure of smaller facilities and venues, high maintenance costs, and lack of funding for construction of new sociocultural venues. This trend is particularly strong in smaller villages, as budgets of various levels do not have the flexibility to support them further, mainly due to such venues being substandard.

Consider the social infrastructures in the rural areas of the Republic of Bashkortostan. The key metrics here are: the availability of preschool education to children aged 1 to 6, the number of hospital beds per 10,000 people, the number of doctors per 10,000 people, the manpower of nursing staff per 10,000 people, the number of seats at cultural venues per 1,000 people.
Table 1. Sociocultural venues funded by municipalities and rural settlements in Russia*

| Municipal institutions | Year   | 2011   | 2012   | 2013   | 2014   | 2015   | 2016   | 2016 against 2011, % |
|------------------------|--------|--------|--------|--------|--------|--------|--------|---------------------|
| education              | 2016   | 63,859 | 61,049 | 58,124 | 57,055 | 55,104 | 52,565 | 82.3                |
| health                 | 2016   | 3,201  | 2,174  | -      | -      | -      | -      | -                   |
| cultural venues        | 2016   | 20,973 | 23,415 | 23,645 | 24,347 | 20,145 | 19,045 | 90.8                |
| sports venues          | 2016   | 3,410  | 2,248  | 2,295  | 2,003  | 1,910  | 1,631  | 47.8                |

*Data sourced from [1-4]

Social security standards are set forth in the Republic of Bashkortostan Government Decree No. 60 dated February 12, 2018 Optimization of Budgetary Funding for the Construction of Social Infrastructures [1-5]. Now let us look at whether the Republic’s rural areas meet these standards in terms of the identified key metrics.

The standard value for preschool education is 700 kindergarten slots per 1,000 children aged 1 to 6. Most of the Republic’s municipalities fail to meet this requirement. As of 2017, only seven municipalities managed to meet it: Kuyurgazinsky, Belokataysky, Khaybullinsky, Fedorovsky, Duvansky, Miyakinsky, and Sterlibashevsky. Abzelilovsky, Belebeyevsky, Beloretsky, and Blagoveshchensky were below 70% of the threshold value.

Healthcare is the pillar upon which social infrastructure is built. The availability of timely high-quality medical aid is prerequisite for good living standards and longevity. Hospital beds per 10,000 people, doctors per 10,000 people, nursing staff per 10,000 people are the metrics of healthcare in municipalities. The Republic’s average is 1.7 times lower than what the standards require (78 beds per 100,000 as opposed to 134.7); in some municipalities, it is as low as 31 or 32 beds (Blagovarsky and Khaybullinsky). Over 2013 to 2017, numbers of beds declined in 42 municipalities out of 54. A positive trend was observed in Arkhangelsky, Duvansky, Kiginsky, and Chishminsky municipalities. Less hospital beds means less available inpatient healthcare.

In rural areas, issues such as the number of doctors in service (specifically specialist doctors) and the nursing staff manpower are grave. Despite the Provincial Doctor Program, municipalities continue losing doctoral HR, see Annex 5. Half of the Republic’s municipalities are also losing nursing staff. Healthcare is becoming ever less available in rural areas. In most of the Republic’s municipalities, the health sector lacks logistics and human resources to provide high-quality healthcare to rural residents. The lack of properly skilled medical staff and zero incentive for them to stay in rural areas are the challengers facing the Republic.

Culture is important to the creation and development of human capital in rural areas. Access to cultural venues and the educational and leisure activities they provide helps develop and convey the basic ideas of moral, ethical, spiritual, and sociocultural development. To assess the cultural state of the art, the research team counted seats in cultural venues per 1,000 people; the numbers were sufficiently high in almost all of the municipalities. Problems lay in other aspects: lack of ICT, shortage of qualified workers, and wear and tear.

Integral metrics showed only Duvansky, Ilishevsky, and Kiginsky Districs had relatively well-developed social infrastructure, see Figure 1. In most rural areas, social infrastructure was substandard and failed to meet the actual needs of their residents.
Figure 1. Integral social infrastructure development index. (data of 2017).

Public utilities are the critical measure of basic standards of living in rural areas. Access to public utilities was measured as the percentage of housing with access to electricity, running water, sewerage, etc. Amenities were the best in the rural settlements of Ufimsky and Sterlitamaksky municipalities, while Burzyansky, Uchalinsky, Baymaksky, Beloretsky, and Zilairsky municipalities underperformed, see Figure 8, Annex 9. In many rural settlements, central water systems are either in disrepair or nonexistent. There is no funds to construct or overhaul such systems, and in some cases, there is no way to obtain funding at all, as the water lines are not owned by any organization, hence no financing. Even the seats often lack central sewerage and water treatment facilities. The existing sewerage and treatment facilities are underperforming; they discharge untreated wastewaters, which jeopardizes the environment and the public health.

Good road infrastructure is necessary for balanced territorial development. A well-built road grid improves commodity exchange, creates better living and economic conditions, enhances the area’s internal and external connectivity. Cars remain the primary mode of transport in the rural areas of Bashkortostan. Local roads and streets complement federal, republican, and intermunicipal highways. The state of local roads is assessed in terms of road-grid density (km per square km), the length percentage of hard-paved roads, and the length percentage of standard-compliant local roads. Hard pavement does not necessarily mean the road complies with the standards; actually, 22 municipalities are below 50% in this regard.

From 2013 to 2017, almost every municipality obtained a denser local road grid. Belokataysky, Yermekievsky, and Sharansky didn’t. In most municipalities, over 80% or even 90% of the local roads qwere hard-paved with high-quality materials (asphalt concrete, cement concrete made of rubble and gravel with binders) or mid-quality materials (rubble and slag). Unpaved roads still accounted for a large percentage (>20%) in Kushnarenkovsky, Tatyshlinsky, Birsky, Baltachevsky, Sharansky, Askinsky, Mishkinsky, Bizhbulyaksky, Arkhangelsky, Buzdyaksky, and Ishimbaysky municipalities.
Figure 2. Public utility index, data of 2017.

Figure 3 shows the integral local road grid metrics for the rural areas of the Republic of Bashkortostan.

Figure 3. Integral metric of local road grids in the rural areas of the Republic of Bashkortostan, data of 2017.
The local roads were found best in Ilishevsky, Karmaskalinsky, and Ufimsky municipalities. They are the worst in Kushnarenkovsky, Birsky, and Askinsky municipalities. All of them except Askinsky have federal and republican highways. Where the local roads were dense and in good condition, the logistics and geography benefited the municipality the most; where the local roads were insufficient, highways only benefited the settlements in their vicinity.

Integral metrics were calculated from the indices of the above-mentioned infrastructure development components. Each integral metric is the mean of related metrics. See Table 2 and Figure 4 for results.

Table 2. Municipalities of the Republic of Bashkortostan grouped by the integral infrastructural conditions index in 2017.

| Integral infrastructural conditions index | Number of municipalities | Municipality |
|------------------------------------------|--------------------------|--------------|
| up to 0.3                                 | 3                        | Burzyansky, Uchalinsky, Baymaksky |
| 0.3 to 0.4                                | 10                       | Iglinsky, Beloretsky, Birsky, Kushnarenkovsky, Askinsky, Blagoveschensky, Abzelilovsky, Mishkinsky, Ishimbaysky, Krasnokamsky |
| 0.4 to 0.5                                | 18                       | Chishminsky, Zilairsky, Khaibullinsky, Sterlitamsky, Kugarchinsky, Baltachevsky, Mechetlinsky, Kaltasinsky, Arkhangelsky, Gafuriysky, Belokataysky, Nurimanovsky, Davlekanovsky, Kuyurgazinsky, Chekmagushovsky, Yanaulsy, Bizhbulaksky, Karmaskalinsky |
| 0.5 to 0.6                                | 21                       | Ufimsky, Blagovarsky, Yermekeyevsky, Alsheyevsky, Aurgazinsky, Burayevsky, Meleuzovsky, Tuimazinsky, Bakalinsky, Karaidelsky, Tatyshlinsky, Belebeyevsky, Duvansky, Kiginsky, Salavatsky, Sharansky, Dyurtyulinsky, Buzdyaksky, Fedorovsky, Zianchurinsky, Sterlibashevsky |
| 0.6 to 0.7                                | 2                        | Ilishevsky, Miyakinsky |
| Total                                    | 54                        | -            |

*Compiled by the author*

Figure 4. Integral infrastructural conditions index.
7. Conclusion
Integral infrastructural conditions index did not exceed 0.65. This means all the rural areas in the Republic of Bashkortostan have problems with their sociocultural infrastructure, roads, and public utilities. Living standards can only be improved in such areas by constructing additional healthcare and educational institutions, hiring more medical staff, repairing and upgrading the public utilities, and expanding the road grid.

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