SUSTAINABLE PLANNING INDICATORS: NORTH KAZAKHSTAN CASE

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Abstract: *This study develops and tests a quantitative indicator system to assess sustainable development in small urban districts in Kazakhstan. The research addresses the lack of measurable tools for small settlements, although they are important for sustainable territorial planning. Its novelty lies in using official socio-economic passport data to build a reproducible system of 18 indicators grouped into demographic, economic and resource-pressure, social-infrastructure, and spatial blocks. The study applied a quantitative case study method using the Bulaevo Urban District in the North Kazakhstan Region as of January 1, 2025. Standardized indicators were compared with regulatory benchmarks, and block and integrated sustainability indices were calculated. The integrated index was 0.19, indicating a low level of sustainability. The main deficits concerned preschool education, employment structure, and agricultural land use. The proposed system can support local authorities in monitoring sustainability, setting planning priorities, expanding preschool infrastructure, diversifying employment, and reducing pressure on agricultural land.*
Keywords: *economic sustainability, planning, small cities, social infrastructure, sustainable architecture.*

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Introduction

Over the past two decades, the issue of the sustainability of small towns and rural settlements has ceased to be a purely regional problem. With the adoption of the Sustainable Development Agenda 2030 in 2015, it was elevated to a global priority. SDG 11 explicitly prescribes making cities and towns of all sizes "inclusive, safe, resilient, and sustainable"[1]. A year later, the New Urban Agenda adopted at the Habitat III conference in Quito consolidated this principle as applied to the "urban-rural continuum" and thereby included small settlements in the priorities of the urban agenda[2].

In 2024, the OECD explicitly stated that small and remote rural areas worldwide face sustained population decline, aging, and service shortages [1]. The gap does not stem from a lack of data, as many countries, including Kazakhstan, collect information regularly and in sufficient detail. In actuality, the gap arises because the collected data is not translated into measurable sustainable development indicators (SDIs) that align with recognized international regulations [2]. Such assessment methodologies have been developed for buildings [3] and large municipal systems [4,5]. However, in our opinion, no such tools have yet been developed for small urban districts, especially in Central Asian countries that emerged after the collapse of the USSR and possess unique socio-economic, cultural, historical, environmental, and climatic features [6]. Individual works on Kazakhstani settlements treat socio-economic factors as a context for architectural and planning solutions [7]. Broader architectural studies also show that future-oriented concepts, including futurism, have influenced the design and architectural solutions of the twentieth and early twenty-first centuries [8]. However, these studies remain primarily conceptual and design-oriented and do not offer a standardized system of measurable indicators for assessing sustainability at the level of small urban districts.

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[1] United Nations General Assembly. Resolution adopted by the General Assembly on 25 September 2015, "Transforming Our World: The 2030 Agenda for Sustainable Development". Available at: https://sdgs.un.org/2030agenda (accessed on July 15, 2026).

[2] UN-Habitat. The new urban agenda. Habitat III. 2016. Available at: https://habitat3.org/the-new-urban-agenda/ (accessed on July 15, 2026).

Background

According to the General scheme of organization of the territory of the Republic of Kazakhstan, the North Kazakhstan Region (NKR) has experienced a steady population decline over the past three decades. Between 1999 and 2019, small towns in the region lost 13% to 25% of their inhabitants [9], making the demographic dimension a priority for assessing a settlement's sustainability. At the same time, the region retains a pronounced agricultural specialization. Agricultural production is the backbone of the local economy and therefore dictates the structure of employment and the nature of the load on land resources [10, 11]. The social infrastructure of small districts was established in the 20th century and has virtually not been updated since then [9].

The northern regions of Kazakhstan have a special place in demographic literature. Here, the spatial and demographic transformation of the 1990s took the form of a massive population flow from small cities to large centers, on a scale unparalleled in any other territory of Central Asia that had gained independence after the collapse of the USSR. The trend of population outflow from small towns persists to this day [12]. As recently as 2024, the annual outflow of migrants from the northern regions reached 1-2%. If the trend continues, the NKR population will decline by 20-25% by 2050. In 2024, the rural population deficit across Kazakhstan reached 111,000 people, marking an all-time record since observations began in 2000. In NKR specifically, mortality consistently exceeds the birth rate [13].

Appasova and Kornilova [7] have observed this pattern at the level of specific settlements, reporting that four small cities in the NKR lost between 5% and 25% of their inhabitants between 1999 and 2025. The researchers associate the population decline with the state of social and communal infrastructure, the results of a sociological survey, and the architectural and planning features of development.

The research goal of the present study was to propose a system of quantitative indicators of sustainable development for the small urban districts of Kazakhstan and to test it using data from the Bulaevo Urban District in the North Kazakhstan Region.

The set goal was achieved through the following objectives: (1) to extract measurable indicators of sustainable development from the data of the district passport; (2) to compare the obtained values with verified regulatory benchmarks; (3) to calculate block and integrated sustainability indices; (4) to conduct a comparative analysis of the two district settlements in relative terms; (5) to identify structural deficits and formulate planning priorities.

Research question: To what extent do the data of the socio-economic passport of the small urban district make it possible to assess the compliance of the settlement with the principles of sustainable development enshrined in international documents?

Literature Review

The transition from descriptive to quantitative approaches to assessing the sustainability of settlements was first marked in scientific literature in the mid-2010s and has since gained significant momentum. Balgarina et al. [14] proposed a conceptual classification of indicators across three dimensions – economic, social, and environmental – emphasizing that there were both synergies and trade-offs among them. The key thesis was that a simple weighted aggregation of indicators without accounting for these relationships distorts the final estimate. An alternative approach focused on buildings and individual facilities was implemented by Hasnash et al. [3]. The researchers extracted indicators from international standards (ASHRAE, LEED, BREEAM), measured them using standard formulas, and compared them with global benchmarks. The results showed a strong position of the assessed object in thermal and energy indicators, with a pronounced deficit in environmental and spatial indicators [15]. Fundamentally, both studies use the same methodological strategy: a fixed set of indicators, verified thresholds, and aggregation into a block index. This exact strategy served as a foundation of our work, although applied to an object with a fundamentally different scale and type of data.

Nurlanova et al. [16] have tested an integrated indicator for the regions of Kazakhstan that relied solely on official statistics, abandoning expert weights. The indicators were grouped into three areas: economy, ecology, and standard of living. The approach was proven to be reproducible for any region of the country without additional data collection.

Quantitative assessment of the sustainability of Kazakhstani cities focuses mainly on large centers. Nyussupova et al. [4] developed an integrated index of sustainable urban development (SUDI) for cities of national importance based on 2007-2019 data, structuring 30 indicators across five blocks. The results suggested a moderate level of sustainability of most of the cities examined, the demographic and environmental blocks being the most problematic [17]. Using a rating methodology with risk analysis, the Eurasian Research Institute[3] and Rozhdestvenskaya and Stroev [18] found that large cities are more sustainable than medium and single-industry ones, mainly by virtue of the economic block.

Both works share a common limitation: the lower limit of the samples included cities with a population of 100,000 or more. Thus, small towns of district significance with a population of up to 15,000 were not included in the systematic estimates. Meanwhile, Kazakhstan has 48 such cities, more than half of the total number of urban settlements in the country[4]. This scale is typical of most NKR administrative centers and is the subject of the present study. At the same time, the above research does not offer a formalized system of measurable indicators that would allow settlements to be compared with one another or their dynamics to be tracked on a single scale.

Thus, research in the field has a methodological gap: tools for quantitative sustainability assessment have been developed only for large cities, individual objects, and the regional level [19]. The urban district, as the minimal planning unit with unified passport documentation, is not represented in these systems [20]. Recent studies also confirm the need to shift from descriptive regional analysis to reproducible quantitative tools to assess economic sustainability at the meso level. Safiullin et al. [21], for example, developed a methodological framework for identifying risks to sustainable regional economic development under the transformation of foreign economic supply chains, combining qualitative and quantitative analysis, cluster analysis, and regression modeling. Although their study focuses on a large regional economy rather than on a small urban district, it supports the broader methodological argument that territorial sustainability requires measurable indicators and transparent analytical procedures.

Without measurable indicators at the district level, SDG 11 remains unattainable in practice, as urban planners lack the information on which parameters do not meet standards and to what extent. This means that the challenge of adopting the SDGs in planning lies in planners' inability to justify development priorities with quantitative indicators.

Methods

The study employed a quantitative case study design with an internal comparison of two subjects. The main subject of research was Bulaevo Urban District as a whole, for which block indices and an integrated sustainability index were calculated. The subjects of comparison were two settlements comprising the district: the central town of Bulaevo and the satellite village of Medvezhka. Their infrastructure profiles were compared in relative terms to reveal intra-district asymmetry. The urban district was selected on three interrelated grounds. Firstly, it represents the most common type of administrative unit in NKR: a small district center with one satellite rural settlement, a combined population of about 9,000, and a pronounced agricultural specialization. Secondly, the district exhibits dynamics typical of the region as a whole, with a population

[3] Eurasian Research Institute. Urbanization and spatial demographic trends in Kazakhstan. Available at: https://surl.lu/vykgco (accessed on July 15, 2026).

[4] Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (BNS RK). Administrative-territorial units of the Republic of Kazakhstan (as of January 1, 2026). Available at: https://surl.lu/dnqrch (accessed on July 15, 2026).

decrease from 9,638 to 9,117 over the period 1999-2025 [7]. Thirdly, the district's socio-economic passport provides a complete set of indicators across all sections, without gaps, which is a crucial condition for building a single-source indicator system. Given that the urban district is the smallest unit of Kazakhstan's settlement network for which such documentation is prepared uniformly, the tested method applies to other districts without additional field research.

The district has a pronounced agrarian spatial structure, as shown in Figure 1. Agricultural land accounts for 88.3% of the district territory, while arable land accounts for 54.1% of agricultural land. In addition, the livestock load coefficient reaches 24.8 head per 100 ha, exceeding the regulatory benchmark of 10.8 head per 100 ha. These parameters show that the environmental dimension of the case is expressed primarily through land-use intensity and resource-pressure indicators rather than through direct measurements of environmental quality.

To clarify this context, Figure 1 combines the regional location of Bulaevo Urban District with a schematic planning profile of the study area. The figure shows the centre – satellite settlement structure of Bulaevo and Medvezhka, transport accessibility, social-infrastructure markers, agricultural land-use context, the integrated sustainability index, and key resource/environmental proxy indicators. It serves as a spatial framework for interpreting passport-based indicators and linking socio-economic, planning, and environmental aspects of the assessment.

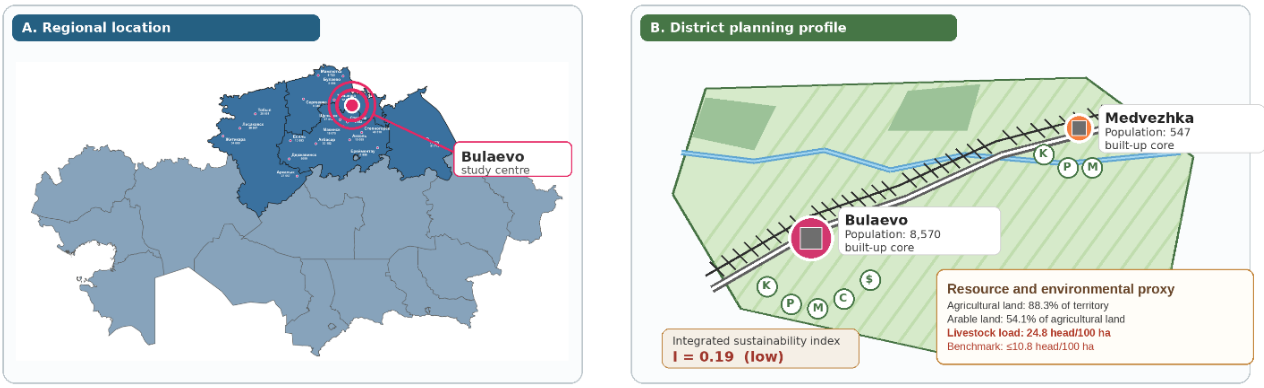

Fig. 1. *Spatial context of Bulaevo Urban District, North Kazakhstan Region: regional location and schematic district planning profile*

Data Sources

The empirical basis of the study was the Socio-economic passport of Bulaevo Urban District, Magzhan Zhumabayev district, North Kazakhstan region, dated January 1, 2025. The passport is formed by the akimat in accordance with a unified form provided by the Ministry of National Economy of the Republic of Kazakhstan. It contains information on eight sections: demographics, labor resources, ethnic composition, land resources, economic entities, livestock, social infrastructure, and employment structure. For the study, 58 primary numerical indicators were extracted from the passport, and calculated indicators were obtained by normalizing them to population size or to the respective age groups.

Benchmark Selection Rationale

Benchmark selection was based on a hierarchical and reproducible procedure. Since the purpose of the study was not to construct an expert rating but to test whether routine district-level passport data can be translated into measurable sustainability indicators, only benchmarks that met four criteria were used. First, the benchmark had to be expressed as a quantitative threshold or normative value. Second, it had to apply to small urban or rural settlements rather than only to large metropolitan systems. Third, the benchmark had to be derived from an official, regulatory, or internationally recognized source. Fourth, the corresponding indicator had to be available in the socio-economic passport without additional field measurement.

Three groups of benchmarks were used. The first group includes national planning and construction standards of the Republic of Kazakhstan, which were applied to social infrastructure indicators such as preschool education, school coverage, hospital provision, and cultural institutions. These benchmarks are directly relevant to settlement planning because they define minimum or recommended levels of service provision for urban and rural communities. The second group includes national statistical reference values from the Bureau of National Statistics of the Republic of Kazakhstan. These values were used for indicators where the benchmark is not a planning norm but a country-level socio-economic reference point, such as unemployment, self-employment, and average household size. The third group includes sectoral environmental and agricultural norms, primarily the maximum permissible livestock load on pasture areas established by the Ministry of Agriculture of the Republic of Kazakhstan. International benchmarks were used only where national planning norms did not provide an equivalent reference value and where the indicator is widely used in comparative rural and demographic studies, such as population aging.

Indicators for which no verified benchmark was available were not excluded from the system. Instead, they were treated as descriptive indicators. This decision was methodologically important because descriptive indicators provide the spatial and socio-economic context of sustainability deficits, whereas their exclusion would have narrowed the analysis to only those aspects already regulated. However, descriptive indicators were not included in the calculation of the integrated index. This avoids pseudo-precision and prevents the arbitrary standardization of indicators for which no reliable threshold exists.

Indicator System

The indicator system was structured around four operational dimensions of sustainable human settlement development: demographic sustainability, economic sustainability and resource pressure, social infrastructure, and spatial sustainability. These dimensions align with the Sustainable Development Goals and the New Urban Agenda but have been adapted to the scale of a small urban district and the structure of Kazakhstan's socio-economic passport data. Demographic indicators correspond mainly to SDGs 3 and 10; economic indicators to SDG 8; social infrastructure indicators to SDGs 3, 4, and 11; and spatial indicators to SDG 11 and SDG 11.a. The resource-use and environmental dimension, linked to SDGs 2 and 15, is represented through land-use and livestock-load indicators in Block II.

The inclusion of indicators was based on two criteria. First, the indicator had to be available in numerical form in the socio-economic passport or be directly calculable from passport data. Second, it had to be relevant for assessing sustainability at the scale of a small urban district, where demographic decline, infrastructure provision, agricultural specialization, and centre–satellite asymmetry are closely interrelated. Indicators were standardized only when a verified quantitative benchmark or reference value was available. Indicators without a verified benchmark were retained as descriptive variables because they characterize the district's spatial and socio-economic context but were not included in the integrated index calculation.

The final indicator set, including the thematic blocks, benchmarks, benchmark sources, assessment type, and SDG alignment, is presented in Table 1. The environmental component is not treated as a separate block of direct ecological quality indicators because the passport lacks data on soil conditions, vegetation cover, pasture degradation, air quality, or water quality. Instead, it is represented by resource-use proxies: the share of arable and agricultural land, land transferred to economic entities, and livestock load. This approach preserves the method's reproducibility while making the environmental relevance of the agrarian land-use structure explicit.

Of the 18 indicators, 9 are standardized because their values can be compared with verified quantitative thresholds or reference values. The remaining 9 indicators are descriptive. They are used to characterize the district's socio-economic, spatial, and land-use context. Still, they are not included in the integrated index due to the lack of verified regional or sectoral benchmarks. This distinction avoids arbitrary normalization and keeps the assessment reproducible for other small urban districts using the same type of passport data.

Table 1. System of SDIs for Bulaevo Urban District

Block	No.	Indicator	Benchmark	Benchmark source	Type of assessment	SDG
I. Demographic sustainability	1	Share of pensioners in the population	~15%	OECD [1]	standardized	3, 10
	2	Proportion of vulnerable groups (pensioners + people with disabilities + low-income)	–	–	descriptive	3, 10
	3	Share of large families in households	–	–	descriptive	3, 10
	4	Average household size	2.5 people	BNS RK[5]	standardized	3, 10
II. Economic sustainability and resource pressure	5	Official unemployment rate	4.7%	BNS RK[6]	standardized	8
	6	Share of self-employed in the working population	23.4%	BNS RK[7]	standardized	8
	7	Business density per 1,000 inhabitants	–	–	descriptive	8
	8	Arable land share in agricultural land as a land-use intensity proxy	–	–	descriptive	2
	9	Livestock load coefficient, head per 100 ha, as a pasture-pressure proxy	≤10.8 head/100 ha	Zootechnical norm for the steppe zone[8]	standardized	2, 15
	10	Agricultural land share in the district territory as an agrarian land-use dominance proxy	–	–	descriptive	15
	11	Share of agricultural land transferred to economic entities as an economic land-use pressure proxy	–	–	descriptive	15
III. Social infrastructure	12	Preschool education coverage	70–80%	SP RK 3.02-110-2012[9]	standardized	4
	13	School education coverage	≥95%	SP RK 3.01-101-2013[10]	standardized	4
	14	Hospital facilities per 10,000 inhabitants	1.0	SP RK 3.01-101-2013[11]	standardized	3
	15	Cultural institutions per 1,000 inhabitants	1.0	SP RK 3.01-101-2013[12]	standardized	11
IV. Spatial sustainability	16	Population density, people/km^2	–	–	descriptive	11
	17	Concentration coefficient (share of central settlement inhabitants)	–	–	descriptive	11
	18	Center/satellite infrastructure asymmetry	–	–	descriptive	11.a

Note: Indicators 8–11 are interpreted as resource-use and environmental proxy indicators. They do not measure environmental quality directly, but characterize land-use intensity, pasture pressure, agrarian land-use dominance, and economic pressure on land resources. Only indicators with verified quantitative benchmarks were standardized and included in the integrated index calculation

[5] Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (BNS RK). Sample survey of households. 2025. Available at: https://stat.gov.kz (accessed on July 17, 2026).

[6] Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan (BNS RK). Employment and unemployment. 2025. Available at: https://surl.li/ywevun (accessed on July 17, 2026).

[7] Ibid.

[8] Order of the Minister of Agriculture of the Republic of Kazakhstan of April 14, 2015, No. 3-3/332 "On approval of the maximum allowable load on the total area of pastures" (rev. 2024). Available at: https://adilet.zan.kz/rus/docs/V1500011064 (accessed on July 17, 2026).

[9] Construction Committee of the Republic of Kazakhstan. SP RK 3.02-110-2012. Preschool education institutions. 2012, rev. 2025. Available at: https://prg.kz/document/?doc_id=32203098 (accessed on July 17, 2026).

[10] Construction Committee of the Republic of Kazakhstan. SP RK 3.01-101-2013. Urban planning. Layout and development of urban and rural communities. 2013, rev. 2025. Available at: https://prg.kz/document/?doc_id=39214714&pos=6;234 (accessed on July 17, 2026).

[11] Ibid.

[12] Ibid.

Analytical Procedures

The analysis was carried out in three stages. At the first stage, the actual value and the deviation from the benchmark, in both absolute and percentage terms, were calculated for each standardized indicator. According to the obtained deviation, each indicator was assigned one of three statuses: "corresponds" (value within the benchmark or better), "borderline" (deviation does not exceed 5 percentage points or 5% of the benchmark), and "does not correspond" (deviation exceeds the specified threshold). Descriptive indicators were interpreted contextually against regional data and results from related studies.

At the second stage, a block sustainability index I_k was calculated for each of the three blocks of standardized indicators:

$$I_k = \frac{n_{corr}}{n_{st}}, \tag{1}$$

where n_{st} – number of standardized indicators in the block, n_{corr} – number of indicators with the "corresponds" status. The value of I_k ranges from 0 to 1. Block IV, "Spatial sustainability", was not included in the calculation due to the lack of verified benchmarks and was analyzed separately by comparing the infrastructure profiles of two district settlements.

At the third stage, the integrated sustainability index was calculated as the arithmetic mean of the three block indices:

$$I = \frac{1}{3}\sum_{k=1}^{3} I_k \,. \tag{2}$$

The blocks were not weighted, as assigning weights would have required an expert assessment procedure beyond the scope of the present study. The integrated index was interpreted using a three-level scale: 0.75–1.00 – high sustainability, 0.50–0.74 – moderate, 0.00–0.49 – low. All calculations were performed using primary data from the socio-economic passport, without inferential statistical methods, in line with the design of a single case study.

Thus, the study consisted of two levels of analysis as described in Table 2.

Table 2. Study design

Level	Subject	Method	Results
District in total	Bulaevo Urban District	Calculation of block indices and the integrated index for 9 standardized indicators	Integrated sustainability index I
District settlements	Bulaevo town and Medvezhka village	Comparison of infrastructure profiles in relative terms (per 1,000 inhabitants)	Intra-district asymmetry profile

The comparison of settlements was carried out without normative benchmarks – by direct comparison of relative indicators. This approach eliminates the effect of the 15-fold difference in population size and enables determination of whether the infrastructure is evenly distributed throughout the district.

Statistical methods (correlation and regression analysis) were not used to test the hypothesis, since the design of a single case study does not imply sample-based conclusions, and the number of observations ($n = 1$) makes such tests methodologically improper.

Results

Block indices based on the 9 standardized indicators indicate that none of the three evaluated blocks meets the threshold for moderate sustainability (Table 3). Block I, "Demographic sustainability", received an index of 0.00 – neither standardized indicator corresponds to the benchmark. Block II, "Economic sustainability and resource pressure," has an index of 0.33: of the three standardized indicators, only the official unemployment rate meets the benchmark. The index value for Block III, "Social infrastructure", is 0.25: of the four standardized indicators, only the availability of hospital facilities meets the standard. Block IV was excluded from the calculation of the integrated index due to the lack of verified benchmarks and is discussed separately through the comparative settlement profile.

The integrated sustainability index based on the three blocks amounted to:

$$I = \frac{0.00 + 0.33 + 0.25}{3} = 0.19. \tag{3}$$

The obtained value corresponds to a low level of sustainability on the adopted scale (0.00-0.49). The district meets standard requirements in only 2 of the 9 standardized indicators – the unemployment rate (2.8%, with a benchmark of 4.7%) and the availability of hospital facilities (1.17 per 10,000 inhabitants, against a standard of 1.0).

Table 3. Block SDIs of Bulaevo Urban District

Block	Standardized indicators	Match benchmark	I_k index	Level
I. Demographic sustainability	2	0	0.00	low
II. Economic sustainability and resource pressure	3	1	0.33	low
III. Social infrastructure	4	1	0.25	low
IV. Spatial sustainability	–	–	–	descriptive
Integrated index	**9**	**2**	**0.19**	**low**

The detailed profile demonstrates not only the status of each indicator but also the extent of its deviation from the standard (Table 4).

Table 4. Standardized indicator profile

No.	Indicator	Fact	Benchmark	d_i, %	Status
1.	Share of pensioners, %	18.3	15.0	+ 22.0	does not correspond
4.	Average household size, people	3.34	2.5	+ 33.6	does not correspond
5.	Unemployment rate, %	2.8	4.7	− 40.4	**corresponds**
6.	Share of self-employed, %	45.1	23.4	+ 92.7	does not correspond
9.	Agricultural load, head/100 ha	24.8	10.8	+ 129.6	does not correspond
12.	Preschool education coverage, %	53.0	75.0	− 29.3	does not correspond
13.	School education coverage, %	92.0	95.0	− 3.2	borderline
14.	Hospitals per 10,000 inhabitants	1.17	1.0	+ 17.0	**corresponds**
15.	Cultural institutions per 1,000 inhabitants	0.55	1.0	− 45.0	does not correspond

Note: $d_i = (x_i - b_i) / b_i \times 100\%$. *For indicators 5 and 14, a negative value means surpassing the standard in the desired direction; for the rest, a deficit relative to the benchmark.*

The most critical deviations are found in three indicators. The share of self-employed exceeds the republican benchmark by 92.7%, indicating a predominance of informal and secondary employment over the formal labor market. The agricultural load on land exceeds the maximum permissible norm by 129.6%. Preschool coverage lags 29.3% below the standard's lower limit, indicating a shortage of places for at least 95 preschool children.

The descriptive land-use indicators clarify the environmental meaning of the resource-pressure block. As visualized in Figure 1, agricultural land occupies 88.3% of the district territory, while arable land accounts for 54.1% of agricultural land. This indicates a highly transformed agrarian landscape with limited non-agricultural buffer areas. The livestock load coefficient is the only resource-use indicator with a verified regulatory benchmark and therefore was included in the standardized part of the assessment. Its value, 24.8 head per 100 ha, exceeds the benchmark of 10.8 head per 100 ha by 129.6%. This result should be interpreted not as a direct measurement of pasture degradation, but as a proxy for potential pressure on land resources.

The nine descriptive indicators reveal the context in which the identified deviations from standards exist.

In the demographic block, vulnerable population groups, including pensioners, people with disabilities, and people with low income, make up 22.8% of district residents. The share of large families is low at 1.5% of households.

In the economic block, business density is 4.7 per 1,000 inhabitants – a low value indicating poor development of small businesses. Only 54.1% of agricultural land is arable. At the same time, 88.3% of the district's territory is covered by agricultural land, resulting in a virtual lack of natural buffer areas [22, 23]. The share of land transferred to economic entities reaches 58.7% of the total agricultural land area.

In the social infrastructure block, school education coverage (92.0%) falls in the borderline zone: technically below the standard, but only slightly. Six preschool institutions have an average group size of 48 children, exceeding the recommended norm (25–30 children), indicating not only low coverage but also overcrowding in existing institutions.

The comparison of the two district settlements in relative terms demonstrates sectoral rather than unidirectional asymmetry (Table 5). With a 15-fold population difference, Medvezhka surpasses Bulaevo in the number of schools, medical facilities, and preschool education coverage. On the other hand, Bulaevo has five cultural institutions, which are completely absent in Medvezhka. The share of pensioners is noticeably higher in the district center, while the proportion of people with disabilities is practically the same.

Table 5. Comparative profile of Bulaevo and Medvezhka (relative indicators)

Indicator	Bulaevo	Medvezhka
Population, people	8,570	547
Households	2,535	193
Average household size, people	3.38	2.83
Schools per 1,000 inhabitants	0.58	1.83
Students per school	231	85
Preschool education coverage, % of estimated preschool-age population	51.5	76.2
Cultural institutions per 1,000 inhabitants	0.58	0.00
Medical facilities per 1,000 inhabitants	0.117	1.828
Share of pensioners, %	18.7	13.0
Share of people with disabilities, %	4.0	4.8

Discussion

The obtained integral index (I = 0.19) corresponds to low sustainability on the accepted scale. Of the nine standardized indicators, only two meet their benchmarks: the official unemployment rate and the provision of hospital facilities. These results are at odds with the picture painted by official statistics. Formally, unemployment in the district is below the republican average, which is traditionally interpreted as a sign of economic well-being. The II-6 indicator, however, suggests otherwise. Self-employed people account for 45.1% of the working-age population in the district, against 23.4% across the Republic of Kazakhstan as a whole. It appears that a significant part of this category consists of subsidiary farming and informal agricultural labor, which, statistically, appears to be employment without creating either a tax base or sustainable income [24]. The OECD [1] reports a similar pattern in small rural districts in different countries, indicating that low official unemployment with high self-employment is not a sign of a sustainable settlement economy [25].

An insightful comparison can be drawn with the results of Nyussupova et al. [4]. With a similar aggregation methodology, large cities in Kazakhstan received moderate sustainability indices (0.5 and higher). Nurlanova et al. [16] confirmed the hypothesis regarding the sustainability of large cities, although small settlements were excluded from the analysis. The index of 0.19 obtained for a small district in our study fits well into this logic: the smaller the settlement, the fewer resources there are to meet standards in several blocks simultaneously.

Block I received an index of zero. The share of pensioners (18.3%) exceeds the OECD benchmark by 22.0% (di = +22.0%), and the average household size (3.34 people) is significantly higher than the NKR regional indicator (2.5 people). The latter fact, however, needs to be interpreted with caution. Large households can reflect both a traditional lifestyle and forced cohabitation for economic reasons. The available passport data are clearly insufficient to distinguish between these reasons.

The most critical deviations are concentrated in Block II. Agricultural load on land exceeds the maximum permissible norm as per the Order of the Ministry of Agriculture of the Republic of Kazakhstan No. 3-3/332[13] by 129.6% ($d_i = +129.6\%$): 24.8 head of cattle per 100 ha against the norm of 10.8 head/100 ha. It is worth noting, however, that the passport provides only the total number of livestock, whereas the standard is calculated relative to pastureland. Since the share of pastures in the total area of agricultural land in the district is unknown to us, we are inclined to believe that the real load on pastures is likely higher than the estimate. Researchers have already cautioned about this exact risk [14, 26, 27], arguing that environmental indicators derived indirectly from aggregated data tend to underestimate the burden on natural resources.

Block III is rather heterogeneous. Coverage with preschool education is 53%, while the lower limit, as per SP RK 3.02-110-2012[14], is 70%. Six institutions have an average group size of 48 children, nearly twice the recommended number. This data indicates not simply a deficit of coverage but an overcrowding of existing institutions. Provision with cultural institutions (0.55 per 1,000 inhabitants) lags behind the standard by 45.0% ($d_i = -45.0\%$). This result is consistent with data from Nyussupova et al. [4], which highlight the cultural block as a systematically weak link in Kazakhstani cities, regardless of their size. At the same time, the present assessment treats educational infrastructure only as basic physical service provision; future versions of the indicator system could supplement school and preschool coverage with qualitative indicators of digital capacity and learning environment, which are becoming increasingly relevant for Kazakhstan's school system [28].

The comparative analysis of Bulaevo and Medvezhka yielded a result different from intuitive expectations. In several respects, the satellite settlement is better provided for than the district center. Medvezhka surpasses the district center in terms of the number of schools, medical facilities, and preschool education coverage per 1,000 inhabitants. In our view, the explanation lies in the historically established logic of standards: the minimum set of objects (as confirmed by other studies – schools, medical centers, kindergartens) was determined for each settlement regardless of its size. The town of Bulaevo later received additional facilities in proportion to population growth and its administrative role. As a result, when infrastructure is normalized by population, the smaller settlement appears to be relatively well provided with basic facilities. This result, however, should be interpreted as a passport-based indicator of service provision rather than as a full assessment of spatial accessibility; such an assessment would require mobility or accessibility modeling [29]. At the same time, Medvezhka is completely devoid of a cultural component, which shows that intra-district asymmetry is sectoral rather than purely quantitative.

This observation echoes the concept of "infrastructural asymmetry" highlighted in OECD documents [1]. The problem of small settlements is often not the absolute absence of facilities, but their sectoral incompleteness. For example, even where basic educational infrastructure exists, the long-term stability of local services may depend on whether the settlement can provide an adequate professional and technological environment for education-sector specialists [30]. The lack of cultural institutions in Medvezhka, despite the availability of a school and a medical center, creates a functionally incomplete environment that keeps residents physically present but fails to provide the quality of life necessary for long-term retention. Appasova and Kornilova [7] reported a similar situation based on a sociological survey. Respondents in the study named the lack of "basic comfortable conditions" as one of the key motives for migration.

Limitations and Further Research Prospects

Three limitations merit separate discussion. The first limitation concerns the time cross-section of the data.

[13] Order of the Minister of Agriculture of the Republic of Kazakhstan of April 14, 2015, No. 3-3/332 “On approval of the maximum allowable load on the total area of pastures” (rev. 2024). Available at: https://adilet.zan.kz/rus/docs/V1500011064 (accessed on July 17, 2026).

[14] Construction Committee of the Republic of Kazakhstan. SP RK 3.02-110-2012. Preschool education institutions. 2012, rev. 2025. Available at: https://prg.kz/document/?doc_id=32203098 (accessed on July 17, 2026).

The socio-economic passport presents indicators at a single point in time, which makes it impossible to analyze dynamics. The calculated integrated index, I = 0.19, reflects the state of Bulaevo Urban District as of January 1, 2025, but does not show whether the sustainability level is improving or deteriorating. This limitation can be overcome either by accessing archival socio-economic passports for previous years or by comparing the passport data with the results of the 2021 national census.

The second limitation concerns the environmental dimension of the assessment. In the revised indicator system, four passport-derived variables are interpreted as proxies for resource use and the environment: arable land share, agricultural land share, land transferred to economic entities, and livestock load. These indicators characterize potential pressure on land resources, but they do not directly measure environmental quality. In particular, they do not show the actual condition of pastures, soil contamination, vegetation cover, water quality, or air quality; these aspects require direct ecological measurements, geobotanical surveys, or specialized modeling approaches [31, 32, 33]. A similar difficulty was noted by Balgarina et al. [14] when developing a regional sustainability index for Kazakhstan: aggregated official data can identify potential sustainability risks, but it should be supplemented by more detailed environmental monitoring. Therefore, the environmental results of the present study should be interpreted as planning signals rather than as a full ecological diagnosis. Future research can overcome this limitation by combining passport data with geobotanical surveys, pasture monitoring, remote-sensing indicators, and local environmental measurements.

The third limitation concerns scalability. The system of 18 indicators was tested on one urban district; therefore, its reproducibility for other districts of North Kazakhstan Region depends on the completeness and comparability of their socio-economic passports. According to our preliminary observations, passport data are not always equally detailed across districts, which may limit direct comparison. A logical next step would be to test the proposed system on a sample of several small urban districts in North Kazakhstan Region. Such testing would enable assessment of the stability of the benchmark-based approach, identification of consistently available indicators, and refinement of the descriptive indicators for broader regional application.

Conclusion

Despite formally satisfactory unemployment rates, Bulaevo Urban District demonstrates low sustainability according to most standardized indicators, with an integrated index of 0.19. Of the nine verified indicators, only two meet the benchmark. Systemic deficits spread across all three blocks with standardized indicators. The most acute problems are observed in preschool education, employment, and the agricultural burden on land.

The scientific significance of the study lies in the finding that district-level passport documentation, previously not considered a basis for indicator assessment, was sufficient to build a reproducible system of 18 indicators. The proposed instrument closes the methodological gap between regional studies of the sustainability of Kazakhstan's cities and real planning practices at the district level.

The practical value of the results is that the developed system of indicators enables a transition from general observations to measurable indicators with regulatory substantiation. The findings point to four priorities for possible improvements in district-level planning: expanding the network of preschool institutions, creating a cultural facility in Medvezhka, diversifying employment, and reducing pressure on agricultural land through pasture-use monitoring and clarification of land-use structure. Each priority has a target value or a measurable planning reference derived from the current norms of the Republic of Kazakhstan, UN documents, or passport-based resource-use indicators, thereby providing a methodological justification for its inclusion in district development programs.

Conflict of Interest

The authors declare no conflicts of interest.

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