Assessment of sustainable development of region

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Abstract. The abstract presents a critical review of the existing approaches to the assessment of the sustainability of the region that defines the development level of the social and economic system. The authors conducted the assessment of sustainability of the biggest region of Kazakhstan, Almaty oblast. The city of Almaty is a city of republican status and is not administratively part of Almaty oblast. The findings showed that in terms of dynamics the development of Almaty oblast as such is characterised as very close to being a sustainable one. Regardless of the fact that environmental and economic subsystems have shown stable growth, the social subsystem has features of instability.

1. Introduction

The problem of providing sustainable development on global, national and local scales has become the pressing issue of modern times. The solution to this problem involves satisfying the needs of generations currently living without jeopardising the needs of future generations. The problem has more urgency at the level of individual regions, because the main inconsistencies and dangers to the sustainable development are especially visible there.

Historically the concept of sustainable development (SD) has arisen as part of dealing with environmental problems, as evidenced by the first appearance of the term in the World Charter for Nature (UN, 1982) [1]. These problems were considered in the Report of the World Commission on Environment and Development: Our Common Future (WCED, 1987) [2] and set out in more detail in 40 chapters of Agenda 21 of the Earth Summit in 1992 (UN, 1992) [3]. These documents have created the foundation for the merging of environmental, economic and social development aspects. (Meadows, 1972) [4].

In 2012 at the UN conference in Rio de Janeiro the report ‘The future we want for all’ was published (UN, 2012) [5]. In this report a great attention was paid to the social foundations as evidenced by the name of the main theme of the summit: ‘The green economy in the context of sustainable development and poverty eradication’. At the early stage of the concept of sustainable development (SD) it has become apparent that the information, and more precisely the quantitative indicators, will play a critical role. The necessity of indicators ‘which show us whether we are creating a more sustainable world’ has arisen. The indicators, set of indicators and indicator dashboards, composite (composite and aggregated) indicators and indices have been developed and introduced. However, despite all the efforts of many national and international organisations and governments,
including long term programs, a consensus over the assessment of the welfare and sustainability has not been reached. (UNECE, OECD, Eurostat, 2008; Stiglitz et al., 2009) [6].

Since 1991 Kazakhstan has successfully overcome the problems of the transition period. Despite the indicators of HDI which have put Kazakhstan at 56th place out of 198, ahead of various European and Central Asian countries, during the period of 1991 to 2014, there were differences in social and economic development between the various regions. The high level of inequality between the regions of Kazakhstan has been classified as a challenge to achieve sustainable development.

The need to level territorial differences and the provision of sustainable development for all regions of the country requires the justification of new approaches to regional policy development and its new role as a transition tool for sustainable development. In Kazakhstan questions concerning the choosing of criteria and indicators of the assessment of the sustainability level of the country’s regions has been opened for discussion.

Theoretical and methodological methods of sustainable development have been researched by Russian, Kazakhstan and international scientists.

Kazakhstan is characterised by its large territory, heterogeneous distribution of natural resources, differences in natural and climatic conditions, and the different level of social and economic development of regions.

Despite the remoteness of most regions of Kazakhstan from maritime transport routes, their geopolitical location could become a favourable factor of sustainable development under the condition of establishing transport and logistics infrastructure between countries of the Asia-Pacific region, China, and Europe. The choice of Kazakhstan’s largest region in terms of geographic area, Almaty oblast, for the assessment of its sustainability is due to its geographical location on the border with China and close proximity to other Central Asian countries.

Almaty oblast is the administrative region located in the south east of Kazakhstan. The area of the region is 223,911 sq km and the population is 2 million. The oblast is divided administratively into 17 districts and 3 cities.

The annual rating of Forbes.kz showed that in 2019 Almaty oblast was in 13th place out of 17 regions in terms of economic development.

After the division of the South Kazakhstan region, Almaty oblast became the most densely populated region with 2 million people, or 11.1% of the country’s population. However, the oblast’s share of GDP is only 4.5%. It has to be noted that this region has low GRP indicators in comparison with the northern regions, where large industrial enterprises are located. In 2018 the oblast’s GRP grew by 3.1% while the national GDP grew by 4.1%.

In 2018 per capita income grew by 8.2% and amounted to 839 thousand tenge a year (13th place) with average growth in the country of 11.6%.

Almaty oblast is located next to the largest city Almaty and has a negative migration balance of 15.5 thousand people. Moreover, the population loss through internal migration is even more and amounts to 16 thousand people [7].

2. Methodology of assessment of region’ sustainable development

The international practice of the creation of sustainability indicators meets the following basic requirements:
- reflecting the social, economic and environmental aspects of development;
- using quantitative parameters;
- using information from official sources, opportunity of comparative analysis;
- reflecting the dynamics of changing of processes in time.

There are two main approaches to the assessment of sustainable development. The first approach assumes the use of the set of indicators, which characterise any given aspects of sustainable development. The second approach is based on the development of one integral indicator that reflects the common sustainability level, or lack thereof, of the system being analysed.
In 1995 the UN Commission on sustainable development approved the set of indicators prepared under the program of the formulation of sustainability indicators, which was published in 1996 and 2001. In 2007 a renewed third set of sustainability indicators was presented along with suggestions of their adaptation to the national conditions and priorities. The sustainability indicators consist of 14 subject categories: poverty, administration, health, education, demography, natural dangers, atmosphere, land, sea and coast, biodiversity, global economic partnership, economic development, models of consumption, and production [8].

Based on the sustainability indicators of 2007 the methodology of comparative analysis of the sustainability of cities was created [9], using statistics of some indicators of London and Saint Petersburg on social, economic and environmental aspects. This methodology was also used for the comparative analysis of the sustainability of Taipei City and Almaty [10]. The sustainability indicators were divided on the provisional basis into 3 sectors: economic which demonstrates cities’ dynamics; social which is connected to the living conditions of the population; environmental which is connected to the consequences of the impact of economic activity on nature. Economic indicators include: gross regional product (GRP), unemployment, gross consumption of electricity and gas. Social indicators include: density of population, life expectancy at birth for men and women, and recorded crimes. Environmental indicators include: total area of territories, percentage of green spaces, greenhouse gas emissions. The comparison of indicators of those cities allowed us to conduct an analysis to determine similarities and differences in their development.

Methodology of sustainability assessment, adopted at the UN conference on sustainable development in 2001, was used for the assessment of sustainability of cities on the Yangtze river delta in China for the period of 2000–2014 [11]. In addition to the thematic system of indicators, cluster analysis and Mann-Kendall trend test were used. Statistical data was used for assessing social, environmental and economic sustainability. All cities’ indicators were combined and standardised to non-dimensional values in the range from 0 to 1 in order to make sustainable development comparable in scale. Next, standardised scores were summed up for every component into scores of social, environmental and economic sustainability for the city. Overall estimates of sustainability were obtained by summing up the indicators of social, environmental and economic sustainability. The Mann-Kendall trend test, which is a non-parametrical statistical test, is normally used for the analysis of trends and discovering mutations in time-series. It defines the tendency of sequence alteration by calculating the standardisation of time series statistics based on the correlation between the ranks of time series and their time order. In the research of cities on the Yangtze river delta in China the Mann-Kendell trend test was applied for finding out the tendencies of general sustainability, social sustainability, economic sustainability and environmental sustainability for the period of 2000 to 2014, and also mutations in time series.

The assessment of sustainability could be conducted with the help of composite indicators of sustainability, generated by aggregating the number of indicators which are selected from a specific structure. Among such indicators are the following:
- Green GDP;
- HDI – Human development index;
- GPI – Genuine Progress Indicator;
- ISEW – Index of Sustainable Economic Welfare;
- HPI – Happy Planet Index;
- ESI – Environmental Sustainability Index;
- EPI – Environmental Performance Index [12].

For the assessment of sustainable development of Almaty oblast the research employs the methodology suggested by Denevisyuk [13]. For its calculation the integral indicators of economic, social and environmental subsystems are built.

The region sustainability index is calculated in the following manner:

\[ I_{CSD} = \sum_{i=1}^{n} w_i \cdot l_i \]
\[ I_i = \frac{1}{m+k} \left[ \sum_{j=1}^{m} I_i^+ j + \sum_{j=1}^{k} I_i^- j \right] \]

\[ I_i^+ j = \frac{I_j - I_{j \min}}{I_{j \max} - I_{j \min}} \]

\[ I_i^- j = 1 - \frac{I_j - I_{j \min}}{I_{j \max} - I_{j \min}} \]

where

- \( I\) \( \text{CSD} \) — region sustainability index;
- \( I_i \) — integral index of the corresponding subsystem (economic, social, environmental);
- \( w_i \) — the weight coefficient of the corresponding subsystem satisfying the following conditions: \( w_i \geq 0, \sum w_i = 1 \);
- \( m \) — number of positive indicators;
- \( k \) — number of negative indicators;
- \( I_i^+ j \) — standardised value of j-th positive indicator, i.e., at increase of which the subsystem improves;
- \( I_i^- j \) — standardised value of the j-th negative indicator, i.e. at increase of which the subsystem deteriorates;
- \( I_{j \min} \) — minimum value of the j-th indicator;
- \( I_{j \max} \) — maximum value of the j-th indicator.

This indicator has been calculated on the base of 33 statistical indicators describing region sustainable development: economic, environmental and social subsystems. System of indicators for each of these subsystems was built taking into account internationally prevailing requirements.

All the data that has been used in the research was taken from the official websites and databases of the Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan, and the Department of Statistics of Almaty oblast [14].

In order to conduct the comparative analysis and a valid analysis it was important to follow the rule of data comparability. The relevant system of indicators characterising region sustainability has been used. In accordance with the practice of forming multidimensional indices, the share of all indicators forming sustainability index is equal. As noted by the researchers, this methodology of aggregate assessment of region sustainability is reliable and applied both for the conditions with minimal initial data and for conditions with a wide range of indicators [15].

The indicators characterising the development of Almaty oblast during the period of 2008 to 2017 have been used in the research.

Region sustainability index is calculated according to the following model:

\[ I_{\text{CSD}} = w_{\text{ECD}} I_{\text{ECD}} + w_{\text{SOCD}} I_{\text{SOCD}} + w_{\text{EnvD}} I_{\text{EnvD}} \]

- \( I_{\text{ECD}} \) — index of economic development of the region;
- \( I_{\text{SOCD}} \) — index of social development of the region;
- \( I_{\text{EnvD}} \) — the index of environmental development of the region.

Sustainability index falls in the range of 0 to 1. Interpretation of the results of sustainability assessment is based on the set limits of allowed values (table 1).

**Table 1. Integral sustainability indicators**

| Integral assessment values | Indicators                  | Integral assessment values |
|-----------------------------|-----------------------------|---------------------------|
| Sustainable                 | 0.85–1.00                   | High sustainability level |
|                             | 0.65–0.85                   | Sustainable level         |
| Medium sustainable          | 0.50–0.65                   | Level closed to sustainable|
|                             | 0.25–0.5                    | Development with signs of instability|
| Unsustainable               | 0.1–0.25                    | Unsustainable level       |
|                             | 0.00–0.1                    | Critical stage of sustainability|

Note: source [14]
Table 2 represents the calculation results of the sustainability index and integral indicators of economic, social and environmental development of Almaty oblast during the period of 2008 to 2017 (table 2).

The economy of Almaty oblast shows gradual growth. As a whole, analysed economic indicators show positive dynamics. In particular, investments into main capital increased by 45%, into residential construction by 54.7%. In the period under review the gross regional product increased by 3.5 times, gross regional product per capita – by 2.9 times, industrial production – by 2.6 times. The level of innovation activity of companies has increased from 1.9% to 8.1%. The level of unemployment decreased by 36%. Integral assessment of the economic subsystem has shown a growth from 0.1 to 0.61 due to positive dynamics of economic indicators. We could observe the changing of assessment from unsustainable development in 2008 to the level close to sustainable in 2017. With that, the period from 2013 to 2016 is characterised as sustainable development of the economic subsystem, where the integral assessment value amounted to between 0.70-0.71.

**Table 2.** Sustainability index and integrated indicators of subsystems of Almaty oblast, 2008–2017

| Year | \(I_{\text{ECD}}\) | \(I_{\text{SOD}}\) | \(I_{\text{EnD}}\) | \(I_{\text{CSD}}\) | Sustainability level |
|------|----------------|----------------|----------------|----------------|---------------------|
| 2008 | 0.10           | 0.38           | 0.29           | 0.27           | Development level with signs of instability |
| 2009 | 0.13           | 0.44           | 0.31           | 0.31           | Development level with signs of instability |
| 2010 | 0.31           | 0.50           | 0.39           | 0.42           | Development level with signs of instability |
| 2011 | 0.48           | 0.54           | 0.28           | 0.47           | Development level with signs of instability |
| 2012 | 0.57           | 0.71           | 0.36           | 0.60           | Level close to sustainability |
| 2013 | 0.70           | 0.62           | 0.45           | 0.62           | Level close to sustainability |
| 2014 | 0.79           | 0.60           | 0.56           | 0.65           | Level close to sustainability |
| 2015 | 0.80           | 0.57           | 0.61           | 0.65           | Level close to sustainability |
| 2016 | 0.71           | 0.58           | 0.63           | 0.63           | Level close to sustainability |
| 2017 | 0.61           | 0.46           | 0.83           | 0.58           | Level close to sustainability |

Note: compiled by authors

The dynamics of development of the social subsystem of the region shows growth during the period of 2008 to 2012. The value of integral assessment of social development index during this period increased from 0.38 to 0.71. The development level of the social subsystem changed from medium sustainable with signs of instability to sustainable development. During the period of 2013 to 2017 the opposite trend is observed. Social instability of the region is connected with a decrease in the main relevant indicators in this area. The share of internet users of the age range of 16-74 years decreased from 62.2% to 59.2%. The crime level increased by 32.5%, the number of criminals doubled. However, there are insignificant growth tendency of housing provision by 18.4%, and a fivefold increase of the number of subscribers of fixed internet connection.

The level of environmental subsystem of Almaty oblast during the period of 2008 to 2017 has changed from medium sustainability with signs of instability to sustainable development. In 2016, the sum of 844,376 thousand tenge was allocated for environmental protection, which is 45% more than in 2008. Emission volumes were significantly reduced: emissions of solid pollutants decreased to 11.2 thousand tons, liquid and gaseous pollutants – up to 32.2 thousand tons, pollutants into the atmosphere – up to 43.4 thousand tons.

3. **Conclusion**

Overall, a positive tendency of sustainability of Almaty oblast for researched period has been observed. The region sustainability index has grown from 0.27 to 0.65. Thus the transition from medium sustainability level with signs of instability to the level close to sustainability has taken place.

Economic and environmental subsystems of sustainable development demonstrate positive dynamics, while the social subsystem demonstrates negative dynamics. The economic subsystem is described as being close to sustainable, the environmental subsystem as sustainable, whereas the social subsystem is medium sustainable with signs of instability. However, the instability of one subsystem...
has been compensated by the higher value of the integral assessment of other systems’ sustainability, and thus sustainability index of Almaty oblast has overall shown positive dynamics.

The goal of region sustainable development is achievable provided that not only economic, but equally social and environmental priorities are implemented.

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