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Ecological and economic development trends of the regions

T B Bardakhanova¹ and Z S Eremko¹

¹ Baikal Institute of Nature Management SB RAS, Ulan-Ude, 670047, Russia

E-mail: zina@binm.ru

Abstract. The current status of regional development is characterized by number of problems, associated with the depletion of natural resources and environmental pollution, that requires the development of green growth strategies. The measures to be taken should be differentiated depending on economic and ecological conditions of regions and their peculiarities. This article proposes a methodological approach to conducting a comprehensive assessment of ecological and economic development of regions. The approach is based on building a matrix of economic and ecological development of regions (a matrix summarizes the changes of numerous environmental and economic indicators, including environmental investments and current expenditures, as well as the main indicators of economic development of various regions). Approbation of the methodological approach was carried out using data on 80 regions of Russia. This approach can be used to assess the effectiveness of environmental and economic integration of transboundary regions, characterized by complex and conflicting environmental and economic interactions.

1. Introduction

In recent decades, the environmental situation in the world (as well as in separate countries and regions) has become an important factor of social and economic development. Problems, related to transition to a green economy and selection of its well-balanced model, are relevant to each country [1-3], including Russia [4-6]. Environmental awareness resulted in development of green growth strategies, which are specific for regions with different economic and ecological conditions.

There are various approaches to the definition of performance management theory and social and economic development [7]; some authors emphasize the need to distinguish between the processes of regional economies development and the processes of their growth [8].

In 2016, experts adapted the UN Sustainable Development Goals (SDGs) targets and indicators to national Russian conditions [9]. Kazakh scientists proposed to use integral indicators to assess the level of green growth in various regions of Kazakhstan. According to assessment results, there is the correlation between level of economic development and current environmental situation in a region [10]. At the same time, the assessment of economic and ecological development of regions on the basis of regular statistical indicators remains relevant.

2. Models and Methods

It is necessary to consider the interrelation between economic and economic-ecological indicators in comparative study of economic and ecological conditions in regions. In view of this, we offer to use indicators, listed in Table 1. Their advantage is that these are the specific indicators, calculated on the basis of official statistics.



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To identify the peculiarities of economic and ecological development of the Russian Federation regions, we propose the following algorithm:

1. Ranking of regions by indicators within 3 categories, based on official statistics (Table 1);
2. The efficiency of ecological policy can be accessed via comparison of regions ranks, determined in terms of ecological conditions and environmental costs level. To determine ranks on the Steps 1 and 2 the adapted hierarchy analysis method has been applied [11-13];
3. Grouping of regions into three subgroups according to the determined ranks: regions with high scores, medium scores and low scores. The interval method was used for grouping regions in this case;
4. Building a matrix of economic and ecological development of regions based on the comparison of level of economic development and efficiency of ecological policy in a specific year;
5. Building a matrix of changes in economic and ecological development of regions for a selected period of time. A region is assigned a value “-2” when moving from a group with high economic and environmental scores to a group with low scores; “+2” – when moving from low scores to high, etc. (Table 2).

Table 1. Categories and indicators of economic and ecological development of regions^a.

Category	Indicators
Assessment of ecological conditions	<ul style="list-style-type: none"> – emissions of pollutants into the atmospheric air (tons per year): per km² (tons/km²), per capita (tons/capita), per unit of gross regional product, GRP (tons/1,000 RUB); – polluted (non-treated) wastewaters that were discharged into surface water bodies per unit area (1,000 m³/km²), per capita (1,000 m³/capita), per unit of GRP (1,000 m³/1,000 RUB); – production and consumption wastes (tons) per unit area, per capita, per unit of GRP (1,000 RUB).
Assessment of environmental costs level	<ul style="list-style-type: none"> – current environmental costs per capita (1,000 RUB/capita); – fixed capital investments for environmental protection (1,000 RUB/capita).
Assessment of level of economic development	<ul style="list-style-type: none"> – GRP per capita (1,000 RUB/capita); – fixed capital investments per capita (1,000 RUB/capita).

^a Source: developed by the authors.

Table 2. Scorecard of changes in a region positioning^a.

high – low	high – medium medium – low	medium – high low – medium	low – high
-2	-1	+1	+2

^a Source: developed by the authors.

3. Results and Discussion

Approbation of the methodological approach was carried out using data on 80 regions of Russia (excluding the Republic of Crimea, Sevastopol and autonomous districts within the Russian regions). Figures 1-3 show the assessment matrices of economic and ecological development of regions in 2010, 2016 and summary matrix of changes in economic and ecological development of regions in 2016 compared to 2010.

Level of economic development			
High 			

Figure 1. Assessment matrix of economic and ecological development of the Russian regions in 2010 (source: developed by the authors).

As a result of this study, 9 types of regions have been identified (the following groups of regions, each of which falls into 3 subgroups: with high, medium and low efficiency of ecological policy):

- regions with high level of economic development;
- regions with medium level of economic development;
- regions with low level of economic development.

Table 3 shows the number of regions, distributed into 9 groups by the development types mentioned above.

Table 3. Breakdown of regions by types of economic and ecological development^a.

Number of regions in grouping	Efficiency of ecological policy					
	Level	Low		Medium		High
	Years	2010	2016	2010	2016	2010
Level of economic development	High	17	15	13	11	3
	Medium	7	10	4	4	4
	Low	3	3	14	8	15

^a Source: developed by the authors.

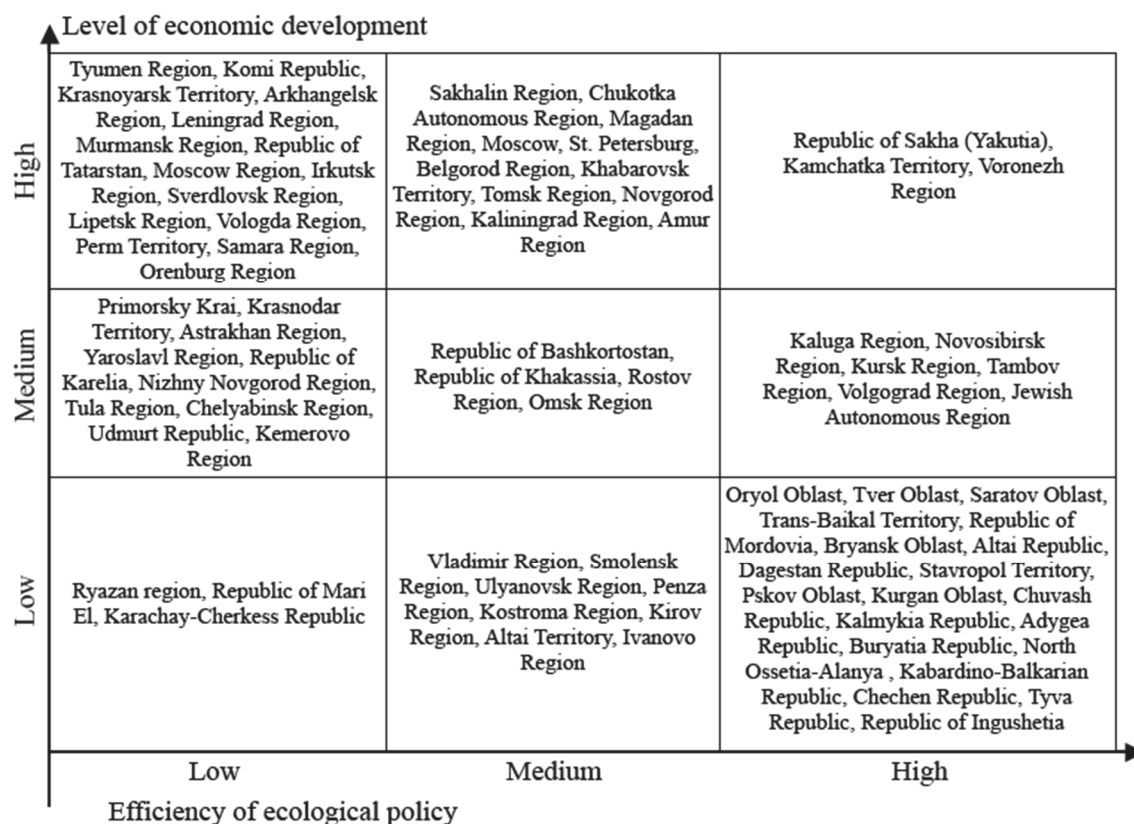


Figure 2. Assessment matrix of economic and ecological development of the Russian regions in 2016 (source: developed by the authors).

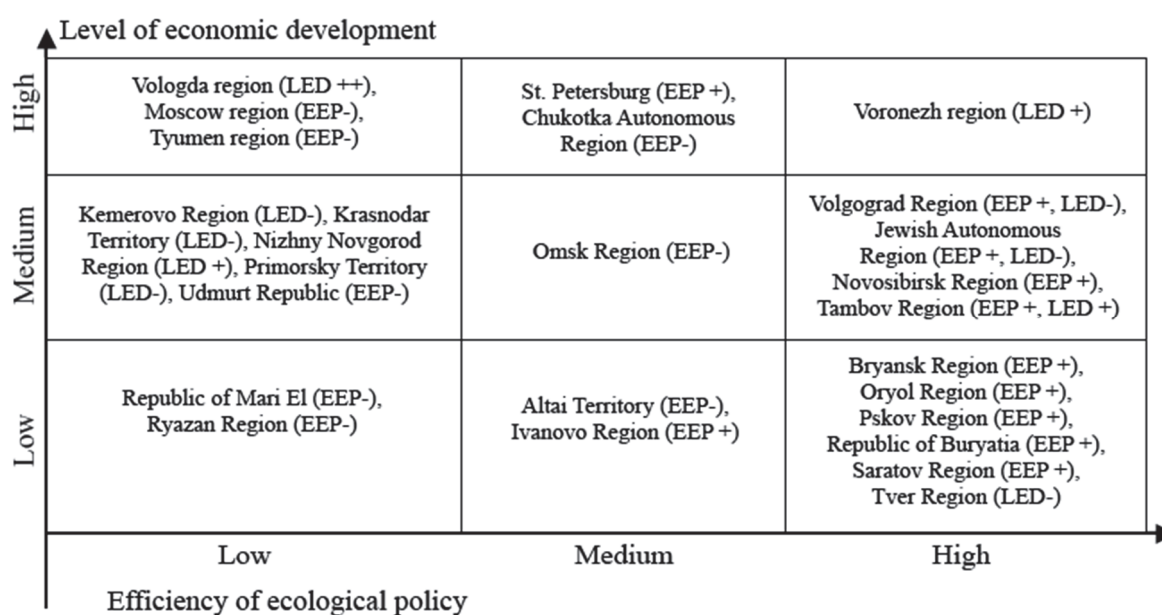


Figure 3. Matrix of changes in level of economic development in 2016 compared to 2010 (source: developed by the authors).

The following notations are used in the matrix on Figure 3: EEP – efficiency of ecological policy, LED – level of economic development, “+” – improvement of indicator in 2016 compared to 2010, «++» - region moving from a group with low scores in 2010 into a group with high scores in 2016; «-» - degradation of indicator in 2016 compared to 2010.

The analysis shows that the number of regions with high efficiency of ecological policy and low level of economic development has increased by 2016 in Russia (from 15 to 20 regions, representing 25 % of the total number of regions considered). The maximum number of regions with low efficiency of ecological policy and high level of economic development was in 2010 (17 regions).

The minimum number of regions with high level of economic development and high efficiency of ecological policy was in 2010-2016 (as well as regions with the opposite situation: low level of economic development and low efficiency of ecological policy).

The analysis of the data presented on Figures 1-3 and in Table 3 shows that there are positive trends in the following types of regions:

1. High level of economic development and high efficiency of ecological policy (the number of such regions remains unchanged);
2. High level of economic development and low efficiency of ecological policy (the number of regions decreased by 2, or 12% of their number in 2010);
3. Low level of economic development and medium efficiency of ecological policy (the number of regions decreased by 2, or 15% of their number in 2010);
4. Medium level of economic development and high efficiency of ecological policy (the number of regions increased by 2, or 50% of their number in 2010);
5. Medium level of economic development and medium efficiency of ecological policy (the number of such regions remains unchanged).

The negative trends are observed in the following types of regions:

1. Low level of economic development and low efficiency of ecological policy (the number of such regions remains unchanged);
2. High level of economic development and medium efficiency of ecological policy (the number of regions decreased by 2, or 15% of their number in 2010);
3. Medium level of economic development and low efficiency of ecological policy (the number of regions increased by 3, or 43% of their number in 2010);
4. Low level of economic development and high efficiency of ecological policy (the number of regions increased by 5, or 33% of their number in 2010).

The following regions demonstrate positive dynamics (Figure 3):

- Tambov Region (EEP+, LED+) where there is an improvement for all the indicators (both economic and environmental: the region has moved from the group with a low level of economic development to the group with a medium level, and in terms of environmental efficiency - from medium to high);
- Vologodskaya Oblast (LED++) moved in 2016 from the group with a low level of economic development to high. It should be noted, that the efficiency of ecological policy has not changed.

The most problematic regions are:

- Tver region (LED-), which is in the group with high efficiency of ecological policy, but its economic development status downgraded from medium to low.
- The Republic of Mari El (EEP-), Ryazan Oblast (EEP-) are still in the group of regions with a low level of economic development and its environmental parameters downgraded from medium to low;
- Altai region (EEP-) also remains in the group of regions with a low level of economic development, but its environmental parameters downgraded from high to medium.

4. Conclusion

The proposed methodological approach allows to carry out comparative economic and ecological analysis of various regions, to rank regions by selected criteria, to reveal positive and negative trends of economic and ecological development of regions and to identify the “best” and “worst” regions.

This assessment showed that the level of economic development of the Russian regions largely predetermines their ecological status. About a quarter of all regions belongs to groups with a high level of economic development and low efficiency of ecological policy, and the number of such regions is decreasing. The second large group – the regions with a low level of economic development and high efficiency of ecological policy. The number of such regions has increased by a third, that requires measures to stimulate economic development.

A matrix of economic and ecological development of regions is based on comparison of numerous environmental, economic indicators (including environmental investments and current expenditures) in various regions. The matrix allows to determine the environmentally acceptable directions of economic growth of a region, to justify green growth strategies, to prepare and implement corresponding investment projects. Supporting priority environmental projects will serve as a catalyst for sustainable development of regional economies.

This approach can be used to assess the effectiveness of environmental and economic integration of transboundary regions, characterized by complex and conflicting environmental and economic interactions.

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