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RESEARCH ARTICLE

Sustainable Development Aspects in the Model of Regional Competitiveness

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ABSTRACT

The purpose of the study was to analyze the integration of sustainable development principles into regional competitiveness models and identify key aspects that determine their mutual influence. The research questions raised in the article are the following: Is there a statistically significant relationship between the competitiveness of a region and the achievement of sustainable regional development indicators? What approaches are used to define this relationship at the conceptual level and through correlation analysis? What components of sustainability (ESG) have the strongest impact on the competitive advantages of territories? The methods employed to achieve the research goal were the analysis of scientific publications on regional competitiveness and sustainable development and the comparison and systematization of empirical and theoretical data. The empirical base for the study was the results of the 2024 AV RCI competitiveness index for Russian regions and the ECG-region rating. Environmental, social, and governance (ESG) factors integrated into regional development form new competitive advantages, thus supporting not only economic growth but also the long-term stability of the territories. The importance of this study lies in the need to balance economic efficiency, social justice, and environmental responsibility in regional development. In this context, the issues of measuring and assessing the contribution of sustainable practices to the competitive positions of the regions are particularly important.

INTRODUCTION

The pressing importance of sustainable development is recognized in the Russian Federation and internationally. In its resolution of August 25, 2023, the UN General Assembly declared the period of 2024-2033 as the International Decade of Sciences for Sustainable Development and called upon both UN member states and other stakeholders, like academia, to "pay attention to the importance of all sciences for sustainable development and raise awareness about it" (United Nations General Assembly, 2023). In the face of increasingly severe environmental, social, and economic challenges, the framework of sustainable development is becoming an integral element in the strategic management of states and regions. While the classic theories of regional competitiveness (Ricardo, 2007; Smith, 1962) prioritize economic factors, current approaches (Perroux, 2007; Porter, 1993); the triple helix model (Etzkowitz, Leydesdorff, 1995); green economy) demonstrate that other factors, including sustainability, become key drivers of long-term competitiveness.

As economic thought evolved, the term "competition," which originally meant the rivalry of economic agents to conquer markets, expanded with the introduction of the concept of competitiveness. The

latter began to reflect the integral characteristic of the ability of subjects to compete effectively. Over time, the concept of competitiveness has reached far beyond individual producers of goods and services, covering regional, national, and international.

Economic science and regional research use several key models to explain the competitiveness of territories. These models can be divided into classical (based on economic factors) and modern (factoring in sustainable development, innovation, and the institutional environment). Classical models rely on analyzing economic factors such as resources, productivity, costs, and trade. They have laid the groundwork for understanding competitiveness but often overlook social and environmental aspects. A prominent example is A. Smith's model of absolute advantage, which asserts that regional competitiveness is determined by the ability of the territory to produce goods with fewer resources compared to other regions. The main emphasis is placed on specialization and resource efficiency (Smith, 1962). In contrast, D. Ricardo's comparative advantage model argues that even if the territory loses in absolute costs, it can be competitive due to specialization in the production of goods, which implies lower relative costs (Ricardo, 2007). This model justifies the importance of international trade.

Seleznev (1999) offers a definition close to the classical understanding: "The competitiveness of a region is the position of the region and its individual producers in the domestic and foreign markets under specific economic, social, political, and other factors, reflected through indicators that adequately characterize this position and its dynamics" (p. 30).

Modern approaches broaden the analysis of competitiveness to cover innovation, institutions, human capital, sustainable development, and environmental factors. They focus on long-term sustainability and the quality of growth. Porter's Diamond model (1990) is among the most widely recognized (Porter, 1993). Porter put forward a systems approach, highlighting four determinants of territory competitiveness: factor conditions (resources, infrastructure, workforce skills); demand conditions (the needs of local consumers); related and supporting industries (clusters); and firm strategy, structure, and rivalry (the competitive environment). A notable new theory of the sources of territory competitiveness has been proposed by R. Florida. In Florida's theory, the focus shifts from resource availability to the region's ability to attract and retain the creative class. Florida (2007) believes that competitiveness should be assessed through the lens of creativity, which covers three key components: technology, talent, and tolerance, each playing an equally important role. An example of a modern approach was the integrated model of territorial competitiveness developed as part of the World Economic Forum (Schwab, World Economic Forum, 2007), which combines various aspects of territorial development, including the economy, the social sphere, innovation, and the environment.

Russian researchers have also made a great contribution to the study of regional competitiveness. Most Russian research on regional competitiveness issues focuses on developing methods to assess and analyze the competitive advantages of a region and to identify key determinants behind it (Chainikova, 2008; Danilov, 2007; Kaliuzhnova, 2004; Khripko, 2012; Tumenova, 2019). A large share of Russian studies is devoted to the practical aspects of developing state policy and strategic approaches to regional economic development and stresses the importance of effective management of regional resources and opportunities to increase the competitiveness of territories (Barabanov, 2014; Grishchenkov et al., 2015; Tatarkin, 2006).

The general trend in regional competitiveness research today is striving to incorporate sustainable development aspects into the models of regional competitiveness. These issues have been addressed by Makarov and Nazarenko (2021), Khisamutdinov and Karachurin (2012), and Guskova et al. (2015). On the Russian scientific information platform Elibrary, the query "regional sustainable development and competitiveness" produces more than 100 results, which demonstrates the interest of researchers in this topic. In our view, the traditional economic paradigm of regional

development is currently giving way to a socio-ecological-economic model. Regions enter escalating competition, and their competitiveness in it is decided not only by the results of socio-economic development but also by their ability to ensure long-term economic stability for investors and social and environmental safety for the population, which create the basis for the sustainable development of the region. As a result, sustainable development is recognized as one of the goals of regional competitiveness management, along with achieving high living standards for the population and realizing the potential of the region.

Sustainable development is broadly understood as enabling the present generation to meet its economic, social, and environmental needs without harming future generations. The foundation for the creation and informational and legal support of international, national, and regional mechanisms of sustainable development is built on the ideas developed at the UN Conferences on the Human Environment (Stockholm, 1972; Rio de Janeiro, 1992 & 2012).

Upon closer inspection, the system of indicators used to assess sustainable development is fairly close to the criteria of regional competitiveness. The United Nations Commission on Sustainable Development (CSD) has built a system of indicators reflecting individual aspects of sustainable development (Tarasova, Kruchina, 2006). Within the general system, there are several typically distinguished subsystems of indicators: environmental, economic, social, and institutional. These indicators can be built into the system of indicators for assessing regional competitiveness, and this work is already underway.

Both the theory of regional competitiveness and the methods of its assessment transform over time. For example, the Global Competitiveness Index (GCI) (Schwab, World Economic Forum, 2007) by Sala-i-Martin and Artadi, which had been published yearly in the World Economic Forum (WEF) Global Competitiveness Report since 2004, was abandoned in 2020. The report determined competitiveness based on twelve main factors that estimated the ability of countries to provide high well-being for their citizens. Aside from its political motives, the WEF's GCI was criticized for not giving enough attention to environmental aspects.

One of the most authoritative world competitiveness studies today is the World Competitiveness Ranking by the International Institute for Management Development (IMD) (IMD World Competitiveness Center, 2025). The IMD ranking analyzes and ranks countries according to 340 competitiveness criteria, focusing on four key factors: economic indicators, government efficiency, business efficiency, and infrastructure. The final assessment relies on a combination of statistical data (2/3) and survey data (1/3) from an exclusive survey of company executives. Unlike the WEF GCI, the IMD ranking has been gradually incorporating sustainable development indicators in recent years.

The Russian Federation has several institutions and rating agencies engaged in calculating indices and rating regions according to various criteria of economic, social, technological, and other aspects of development. For our study, of interest are those that assess the competitiveness and sustainable development of the regions. Table 1 lists a few of the ratings published from 2024 to the 1st half of 2025 that summarize information on the state of the Russian regions.

Table 1: Ratings and rankings of Russian regions by competitiveness and sustainable development (published in 2024 – 1st half of 2025)

No.	Title	Developer	Data relevance[2]	Month and year of publication of the latest rating[3]
1	Final rating of Russian regions	RIA rating	2023-2024	December 2024
2	Region Competitiveness Index (AV RCI) rating	AV Group	2022-2023	November 2024

3	Rating of regions by the financial well-being of the population	RIA rating	2023	October 2024
4	Rating of Russian regions by quality of life	RIA rating	2023-2024	February 2025
5	Assessment of investment attractiveness of Russian regions	National Rating Agency (NRA)	2023 - 1st half of 2024	November 2024
6	Ranking of the sustainable development and integration of ESG criteria into the activities of the constituent entities of Russia	NRA	2022-2024	March 2025
7	"ECG-region" rating	RAEX rating agency	2022-2024	June 2025
8	Ecological rating of Russian regions	All-Russian public organization "Green Patrol"	March-May 2025	June 2025

Source: compiled using data from Batchaev (n.d.)

The data from these rankings will be used to address the research question of whether there is a statistically significant relationship between the level of regional competitiveness and the indicators of sustainable regional development. The sources for the analysis of interconnections and interdependencies were the 2024 AV RCI 2024 and the ECG-region ratings. This choice was made because these specific ratings and their developers have proven themselves in the Russian market, where they are used to develop development strategies for Russian regions and the country overall. Importantly, their data and methods are openly available.

The AV RCI rating is published annually by AV Group (2024). It provides a comprehensive assessment of a territory's ability to compete for resources and markets. The main purpose of the rating is to assess factors that reflect the results of interregional competition. The rating assesses the contribution of regions to the development of Russia and the level of their competitiveness and identifies key leaders in growth. The methodology covers seven areas of competition between regions:

- Markets (products and economic complexes);
- Institutes (public, private, and public);
- Human capital;
- Innovation and information;
- Natural resources and sustainable development;
- Space and real capital;
- Investments and financial capital.

ECG-region is Russia's first rating to estimate how well regions achieve national sustainable development goals (RAEX Rating Review, 2025). The project was developed by the RAEX agency together with the compilers of the ECG business reputation rating.

The rating is built on 17 indicators grouped into three blocks: Ecology (20%), Personnel (40%), and Government (40%). The Ecology block evaluates the indicators of water consumption, pollutant emissions, and the quality of neutralization of atmospheric pollutants. The Personnel block focuses on population living conditions, including life expectancy, birth rate, and migration growth. The Government block targets budget self-sufficiency, the implementation of national projects, and the presence of a regional support system for responsible business. Statistical data are supplemented by average scores in Ecology, Personnel, and Government from regional participants of the ECG rating.

Data from different rating agencies were used to avoid multicollinearity, in which several indicators in the model strongly correlate with each other and essentially carry the same information. In the process of research, we did attempt to analyze the relationship between the regional competitiveness index and the index of achieving sustainable development using information from the same rating agency and obtained a correlation coefficient value of 0.98, which indicates multicollinearity.

Table 2 shows integrated regional ratings taken from the ratings listed above. The table provides data for 82 regions of the Russian Federation, except for the cities of federal significance (Moscow, St. Petersburg, and Sevastopol) and the new regions of Russia.

Table 2: Russian Region Competitiveness Index (AV RCI 2024) and the ECG-region rating (regional sustainable development)

	Region (without federal cities: Moscow, St. Petersburg, Sevastopol)	Region Competitiveness Index	ECG-region rating (regional sustainable development)
1	Moscow Oblast	3.773	48.01
2	Republic of Tatarstan	3.694	56.76
3	Krasnodar Krai	3.345	43.00
4	Sverdlovsk Oblast	3.156	47.96
5	Khanty-Mansi Autonomous Okrug	3.027	65.10
6	Krasnoyarsk Krai	3.018	48.13
7	Rostov Oblast	2.909	46.69
8	Novosibirsk Oblast	2.8010	42.90
9	Chelyabinsk Oblast	2.7811	49.18
10	Samara Oblast	2.7712	40.31
11	Yamalo-Nenets Autonomous Okrug	2.7414	60.68
12	Nizhny Novgorod Oblast	2.7413	44.91
13	Republic of Bashkortostan	2.7015	46.59
14	Irkutsk Oblast	2.6516	44.56
15	Perm Krai	2.5617	50.14
16	Tyumen Oblast (without the AO)	2.4918	57.13
17	Republic of Sakha (Yakutia)	2.4719	45.82
18	Voronezh Oblast	2.3620	50.22
19	Leningrad Oblast	2.3421	53.62
20	Belgorod Oblast	2.3322	48.69
	…		
82	Jewish Autonomous Oblast	0	37.41

Source: compiled based on AV RCI 2024 (AV Group, 2024) and ECG-region (RAEX Rating Review, 2025)

The AV RCI-2024 rating shows significant differences in competitiveness between different regions of Russia. The leading positions are held by large urban agglomerations and economically developed constituent entities. The leaders in the TOP 20 of the 2024 AV RCI are Moscow Oblast, the Republic of Tatarstan, Krasnodar Krai, the Khanty-Mansi Autonomous Okrug – Yugra, and Krasnoyarsk Krai. These regions are distinguished by high levels of economic activity, investment attractiveness, and quality of life. The main factors contributing to the high competitiveness of these regions are a high level of investment, developed infrastructure, quality education and training, innovative technologies and research, a favorable investment climate, and effective government institutions.

In the federal ECG-region rating, the leaders are the Khanty-Mansi and Yamalo-Nenets Autonomous Okrugs and Tyumen Oblast. Their success owes to similar factors. Despite being the main oil and gas centers of the country, these regions have some of the greatest environmental indicators. This comes as a result of moderate water use and atmospheric pollution, which seem insignificant against the large volumes of hydrocarbon production. In the field of human resources, these regions are distinguished by high population well-being and good life expectancy. In terms of public

administration, the regions have high fiscal capacity and strict discipline in financing national projects.

Interestingly, only Yamalo-Nenets Autonomous Okrug is at the top of both ratings, while the rest of the regions did not fall into the intersection.

To discover potential relationships between the sustainable development of the regions and their competitiveness, we will build a scatter plot (Figure 1) using data from Table 1.

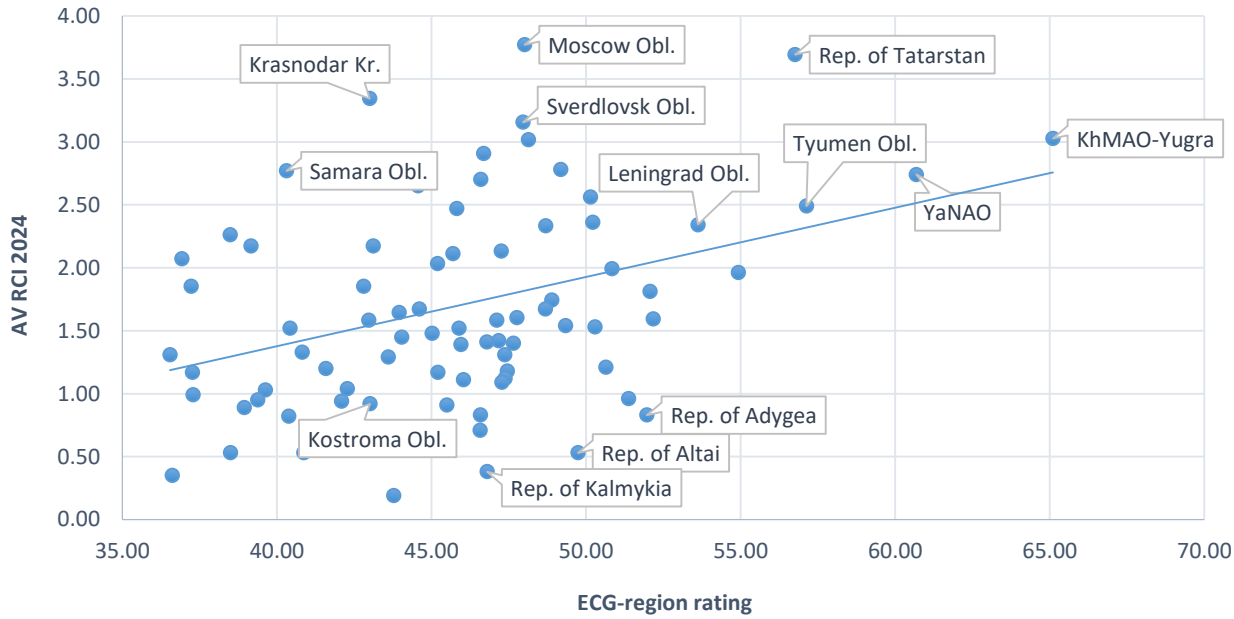

Figure 1: The Russian Region Competitiveness Index (AV RCI 2024) and the ECG-region rating scores (regional sustainable development)

Source: AV Group, 2024; Federal State Statistics Service, n.d.

In Figure 1, we can see a round cloud of points, which still has an upward slope to the right, showing the positive correlation of the two variables. Although the dots form a roughly circular pattern, the overall trend is that an increase in one variable is associated with an increase in the other. This means that although the relationship is not strictly linear, there is a general trend of growth in both variables simultaneously. The points are scattered around an imaginary regression line running from bottom left to upper right. Thus, the plot portrays a moderate to weak positive relationship between the studied indicators, meaning that the growth of one indicator is associated with the growth of the other.

Pearson's correlation coefficient (r_{xy}) delivers the same results. R_{xy} for the given data set is 0.37. That is, the correlation between regional sustainability and competitiveness does exist, but it is moderate, since Pearson's r falls in the range of $0.30 < |r_{xy}| < 0.49$.

The reliability of the correlation coefficient is determined using the empirical value of Student's t-test:

$$t_r = |r_{xy}| \cdot \sqrt{\frac{n-2}{1-r_{xy}^2}} = 3.79,$$

where n – the number of observations.

For the significance level of α=0.05, the critical value ofStudent's t-test is t_{crit}=2.0. Thus, $t_r > t_{crit}$, since 3.79 > 2.0, so the correlation is concluded to be significant at the level of α=0.05.

The equation of paired linear regression with regional competitiveness as the dependent variable and the region's sustainable development rating score as thef the independent one takes the form:

$$y=0.055x-0.8236$$

and shows that with a one-point increase in the indicator of regional sustainable development, the competitiveness index increases by 0.055.

Most regions are concentrated near the regression line, but there are deviating points that suggest contradictions in the relationship between the variables. For one, there are regions with a low level of sustainable development despite a high level of competitiveness. This group of regions includes Moscow Oblast, Krasnodar Krai, and Sverdlovsk Oblast. Other regions have a relatively high ECG rating but an extremely low competitiveness index. These include the Republic of Adygea, the Republic of Altai, and the Republic of Kalmykia, which belong to depressed regions and remain under the scrutiny of federal authorities and the expert community, requiring comprehensive support and the improvement of the quality of life.

The analysis of the relationship between sustainable development and the competitiveness of the region was continued using the same sources but with an expanded data set. As mentioned earlier, the ECG-region rating is calculated according to three groups of factors: Ecology, Personnel, and Government. The results of correlation analysis for these groups by factors and the regional competitiveness index are presented in Table 3.

Table 3: Correlations between sustainability factors and the competitiveness index

	Ecology factor	Personnel factor	Government factor
Coefficient of correlation between the competitiveness index and the sustainability factor	0.36	0.51	0.08
Student's t-test	2.75	3.72	0.70

Source: calculated based on AV RCI 2024 (AV Group, 2024) and the 2025 ECG-region rating (RAEX Rating Review, 2025)

It can be concluded that the competitiveness and sustainable development of the region are interdependent and interconditional, which can be largely seen from the integration of these economic phenomena.

Moreover, this dependence can be both direct and inverse and has a dual, contradictory character. Undoubtedly, the competitiveness of the region creates prerequisites for its sustainable development. At the same time, sustainable regional development is an indispensable driver of the region's competitiveness both in the interregional and international markets. The direct dependence is characterized by the fact that a region that works on sustainable development goals and has a stable socio-economic and natural environment system becomes more attractive to the population and business, and therefore more competitive (Shumilova et al., 2021).

Factor analysis reveals that competitiveness has the strongest relationship (r=0.51) with the Personnel factor, which is a group of social indicators responsible for the level of income and living standards of the population in the ECG-region rating. In other words, regions that perform well in this block are highly competitive, and vice versa.

The inverse dependence of the sustainable development of the region and its competitiveness is driven by the fact that the improvement of competitiveness through production growth, i.e., intensive industrial development, often entails negative consequences. Some of these include environmental

degradation, the depletion of natural resources, and environmental pollution, which are contrary to sustainable development.

Accordingly, the Ecology factor has a weaker association with the competitiveness index. According to our calculations, r=0.36, which does suggest a positive relationship between the indicators, but an increase in the region's competitiveness index is not always accompanied by a similar change in the Ecology factor.

Notably, the Government factor has a rather insignificant relationship with the regional competitiveness index (r=0.08, Student's t-test 0.7 < 2.0), which is ignored during the analysis, as there is either no statistically significant relationship between the variables or it is random.

CONCLUSIONS

The analysis of the relationship between sustainable development and regional competitiveness carried out in this article confirms the hypothesis that the integration of sustainable development principles into regional development strategies becomes a key factor in the formation of long-term competitive advantages. Correlation analysis based on AV RCI and ECG-region ratings found a moderate positive relationship between the level of competitiveness and indicators of sustainable development (Pearson's r=0.37). A particularly significant link was observed between competitiveness and the social aspects of sustainability (Personnel, r=0.51), which emphasizes the value of investment in human capital, quality of life, and social infrastructure. At the same time, there was a weak correlation with environmental indicators (0.36) and no statistically significant relationship with the Government factor (0.08). These results suggest that sustainable development processes in Russian regions are heterogeneous and inconsistent, meaning that economic growth is not always accompanied by improvements in the environmental situation or the effectiveness of public administration.

Modern competitiveness models, such as Porter's theory, the triple helix by Etzkowitz and Leydesdorff, and approaches integrating ESG criteria, prove the need to transition from a narrow economic paradigm to a multidimensional model that factors in social, environmental, and institutional factors. In Russian practice, the leading regions (e.g., the Republic of Tatarstan and the Khanty-Mansi Autonomous Okrug) successfully combine high competitiveness with progress in sustainable development, yet most territories suffer from imbalances, for example, high economic potential with low environmental standards or social inequality. This raises the need to revise regional strategies to harmonize economic, social, and environmental goals, as well as strengthen the role of public institutions in coordinating sustainable practices.

Ultimately, sustainable development should be viewed not only as a goal but also as a tool to boost regional competitiveness that fosters a stable and attractive environment for investors, business, and the population. Further research in this area should be aimed at developing adaptive assessment methods that account for the specifics of the Russian regions, as well as finding mechanisms to overcome the contradictions between short-term economic interests and the long-term priorities of sustainable development. In the face of global challenges and escalating competition between territories, the integration of sustainable practices will become the key to the successful development of regions in the 21st century.

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