World Journal of Environmental Biosciences
Available Online at: **www.environmentaljournals.org**

Volume 15, Issue 3: 48-59

https://doi.org/10.51847/tKOJvVnEBK

ISSN 2277- 8047

ESG Development in Large Companies: Environmental and Social Aspects

Darkhan Saparbaiuly[1], Olga Petrova[2], Alexander Lisovsky[3], Diana Stepanova[4], Oxana Chernova[5], Aleksandr Litvinov[6,7], Andrey Zharov[8]*, Aleksandr Shelygov[9]

[1]Higher School of Postgraduate and PhD programs, International University of Kyrgyzstan, Bishkek, Kyrgyzstan.
[2]Department of Business Analytics, Financial University under the Government of the Russian Federation, Moscow, Russia.
[3]General Director of JSC NPO Krypten, Moscow, Russia.
[4]Higher school of finance, Department of State and Municipal Finance, Plekhanov Russian University of Economics, Moscow, Russia.
[5]Department of Foreign Languages, Academy of Engineering, Peoples' Friendship University of Russia (RUDN University), Moscow, Russia.
[6]Department of Foreign and Russian Philology, Moscow State University of Psychology and Education (MSUPE), Moscow, Russia.
[7]Department of Foreign Languages, Faculty of Economics, Peoples' Friendship University of Russia (RUDN University), Moscow, Russia.
[8]Department of Technosphere Safety, Peoples' Friendship University of Russia (RUDN University), Moscow, Russia.
[9]Moscow Polytechnic University, Moscow, Russia.

ABSTRACT

The integration of sustainable development principles into corporate strategies is becoming a critical factor for the effective strategic planning and competitiveness of large companies in transition economies. This study aims to conduct a comparative analysis of sustainable planning strategies adopted by large companies in Russia and Kyrgyzstan in the energy, transport, and industrial sectors, with a particular focus on environmental initiatives and social programmes. A mixed-methods research design was applied, combining structured content analysis of corporate sustainability reports (inter-coder reliability: Cohen's Kappa = 0.82), semi-structured expert interviews (n = 12), and statistical analysis of sustainability performance indicators for 24 companies (15 Russian and 9 Kyrgyz firms) over the period 2020–2024. The results indicate that Kyrgyz companies in the sample demonstrate higher growth rates of relative investments in sustainable development (+2.1% versus +1.6% of revenue) and a statistically significantly stronger correlation between environmental investments and financial performance ($r = 0.65$, $p < 0.01$) compared to Russian companies ($r = 0.42$, $p < 0.05$). Statistically significant differences with medium effect sizes were identified in the intensity of investments in social programmes ($U = 45.5$, $p = 0.032$, $r = 0.44$) and the emphasis on renewable energy development ($U = 38.2$, $p = 0.018$, $r = 0.48$). The study demonstrated that under conditions of resource constraints, sustainable development becomes a strategic mechanism for compensating competitive disadvantages, enabling companies to transform limitations into competitive advantages through targeted allocation of investments.

Keywords: *Competitive advantages, Energy sector, Environmental initiatives, Industry, Social responsibility, Transport*

Corresponding author: Andrey Zharov
e-mail ✉ a_n_zharov@mail.ru
Received: 01 July 2026
Accepted: 12 August 2026

INTRODUCTION

In the modern world, large companies play a key role in achieving sustainable development goals since their growth strategies can significantly influence the environmental situation and the social well-being of regions (Steblyanskaya *et al*., 2020; Stryabkova *et al*., 2025). Scholars emphasize that business success is measured not only by profit but also by its contribution to addressing environmental and social challenges (Sozinova *et al*., 2022; Kuandykova *et al*., 2024). Modern studies demonstrate the growing integration of sustainable development principles into corporate growth strategies (Osadchy *et al*., 2024; Fernandes & Gabriel, 2025), with environmental initiatives and social programmes being regarded not as additional costs but as strategic investments in long-term competitiveness (Nguyen & Kanbach, 2024; Tuleyeva *et al*., 2024). This is particularly relevant for the energy,

industrial, and transport sectors, which are characterized by high levels of environmental impact and considerable social influence (Ilyushin & Afanaseva, 2020; Shahbaz *et al*., 2024).

Large enterprises face the task of integrating sustainable development principles into their operations while considering national regulatory frameworks and market conditions (Khalipov, 2024; Zheldybayeva *et al*., 2025). However, the mechanisms for effectively incorporating environmental initiatives and social programmes into the growth strategies of large companies in transition economies remain insufficiently understood (Klochko, 2024; Akhmetshin *et al*., 2025). Existing studies demonstrate regional and sectoral differences in how corporations balance financial performance with sustainability imperatives under varying regulatory requirements and market pressures (Shayakhmetova *et al*., 2023; Stankevich *et al*., 2023).

The conceptual foundations of sustainable development in large corporations can be systematized according to three key groups of factors **(Table 1)**.

Table 1. Conceptual foundations of sustainable development in large corporations

Factors	Brief description	Main sources
Economic factors	Integration of financial indicators into sustainable growth indices; entropy-based method for determining weighting coefficients; relationship between ESG indicators and company financial performance; systemic balance of corporate development	(Steblyanskaya *et al*., 2020; Golovina *et al*., 2023; Kasradze *et al*., 2023)
Environmental factors	Greenhouse gas emission reduction programs; improving energy efficiency and transitioning to renewable energy sources; waste management and water resource protection; achieving carbon neutrality; integration of environmental priorities into strategic planning	(Gough, 2016; Ruban *et al*., 2021; Starikova & Shamanina, 2021; Jiménez-Parra *et al*., 2025)
Social factors	Corporate social responsibility programs; personnel development and employee engagement in environmental initiatives; corporate eco-culture and social norms; social support for local communities; internal and external aspects of social responsibility	(Arzamasova & Esaulova, 2021; Sozinova *et al*., 2022; Stankevich *et al*., 2023; Li, 2024; Costa & Opare, 2025)

Modern research demonstrates an evolution from traditional, financially oriented strategies to comprehensive sustainable development models. Steblyanskaya *et al.* (2022) developed a sustainable growth index combining financial, energy, environmental, and social subsystems, while Golovina *et al*. (2023) proposed an entropy-based method for determining indicator weights in a multidimensional sustainability assessment model.

Approaches to sustainable development differ across industries. Energy companies primarily focus on reducing emissions and transitioning to renewable energy sources, although environmental priorities are not always sufficiently integrated into strategic planning (Ruban *et al*., 2021; Ilyushin & Martirosyan, 2024). Transport companies concentrate on infrastructure investments and coordinated efforts to achieve carbon neutrality (Krois *et al*., 2021; Borowski, 2024). Industrial enterprises generally apply a more comprehensive approach by integrating environmental and social criteria into production management (Grafkina *et al*., 2023; Tiuncika & Bormane, 2024). Both internal and external factors influence the successful implementation of sustainability strategies (Hulaifi *et al*., 2025). Regulatory pressure and stakeholder engagement are important drivers of corporate environmental policy (Jiménez-Parra *et al*., 2025), while corporate eco-culture and employee involvement determine the effectiveness of environmental initiatives (Li, 2024; Costa & Opare, 2025). The integration of lean production principles into organizational culture may also improve the efficiency of corporate processes, including sustainability programmes (Sergeeva *et al*., 2024). Thus, all three sectors are influenced by the regulatory environment, whereas corporate culture and employee engagement remain important but often underestimated success factors (Samushkin, 2024).

The comparison of Russia and Kyrgyzstan is particularly relevant because the two countries share a common institutional heritage but differ in economic scale, regulatory development, sectoral priorities, and approaches to integration into the global economy. In Russia, large companies in the energy, extractive, industrial, and transport sectors are increasingly developing environmental strategies and integrating sustainability principles into their operations (Battakhov & Ovchinnikova, 2024; Faizulina *et al*., 2024; Kokurin *et al*., 2025). Energy companies are implementing energy-efficiency and environmental programmes, while transport companies focus on reducing their carbon footprint and strengthening social responsibility (Zitrický *et al*., 2017; Sassi, 2022; Klepikov & Klepikova, 2023; Shaimerdenova *et al*., 2023; Wang *et al*., 2023).

In Kyrgyzstan, sustainable development is also becoming an important component of state and corporate policy. National development priorities emphasize environmentally sustainable growth in energy, industry, and transport (Herrero *et al*., 2020). The country's mountainous geography and water resources create favorable opportunities for hydropower development (Orazaliev *et al*., 2024), while enterprises operating in hydropower and mining increasingly apply international environmental management and social responsibility standards (Nuralieva, 2022).

Large enterprises in both countries therefore face a similar challenge of integrating sustainable development principles into their operational and strategic activities. However, they do so under different regulatory conditions, economic capacities, and sectoral structures. A comparative study of corporate sustainability practices in Russia and Kyrgyzstan can identify both common trends and country-specific characteristics, which is particularly valuable for understanding sustainable development in Central Asia and neighboring post-Soviet economies (Zhukov *et al*., 2023; Atasheva *et al*., 2024; Battalova & Enikeev, 2024).

The objective of this study is to analyze the sustainable planning strategies of large companies in the transport, industrial, and energy sectors of Russia and Kyrgyzstan, with particular

attention to environmental initiatives and social programmes as components of corporate growth.

The study addresses the following research questions:

1. How do large companies integrate environmental initiatives and social programmes into their growth strategies?
2. What factors determine the effectiveness of implementing sustainable development principles in corporate planning?
3. What country and sectoral differences exist in approaches to sustainable planning among transport, industrial, and energy companies?

The scientific significance of the study lies in expanding the understanding of sustainable corporate planning across different economic contexts and assessing whether the success of sustainability strategies is determined by the absolute scale of investments or by their strategic focus and integration into the overall business strategy. The practical significance lies in identifying opportunities for mutual learning: Russian companies may benefit from closer integration between environmental investments and financial performance, while Kyrgyz enterprises may draw on Russian experience in technological innovation and comprehensive sustainability programme management. For policymakers, the findings emphasize the importance of regulatory support, international cooperation, human-capital development, and the exchange of sustainable business practices (Bobkov & Shichkin, 2024; Grishin & Bykova, 2024).

MATERIALS AND METHODS

Research design

This study employs mixed methods, combining qualitative and quantitative approaches to analyze the sustainable planning strategies of large companies in the transport, industrial, and energy sectors in Russia and Kyrgyzstan.

Data sources and samples

For the purposes of this study, large companies were considered enterprises that meet at least two of the following criteria:

Table 2. Criteria for Defining Large Companies in Russia and Kyrgyzstan

Criterion	Russia	Kyrgyzstan
Annual revenue	Over 50 billion rubles	Over 1 billion soms
Number of employees	More than 5.000 people	More than 1.000 people
Ranking position	Inclusion in the top-200 largest companies in Russia	Inclusion in the list of system-forming or strategic enterprises of the country
Scale of presence	Branch network in several regions or international presence	Market share in its industry more than 10%

Differences in threshold values reflect the objective differences in the scales of the economies of the two countries and ensure the comparability of the status of companies as "large" in the national context.

Criteria for company selection:

- Scale of operations: companies had to meet the definition of a "large company" according to the criteria described above (revenue, number of employees, market position).
- Sector affiliation: operation in one of the three target sectors—energy, transport, or industry. These sectors were selected due to their high environmental impact and significance for the national economies of both countries.
- Availability of information: presence of publicly available reporting on sustainable development or corporate social responsibility for the period 2020–2024, including annual reports, sustainability reports, corporate websites, and strategic documents.
- Representativeness: To ensure sample balance, the principle of equal sector representation in each country was followed (5 Russian and 3 Kyrgyz companies per sector).

The final sample Includes 24 companies: 15 Russian and 9 Kyrgyz enterprises. A detailed sample description is presented in **Table 3**. Anonymization of some company names is due to confidentiality requirements from research participants.

Table 3. Detailed Characteristics of the Research Sample

No.	Country	Sector	Company	Ownership Form	Scale of Activity
1	Russia	Energy	PJSC “Gazprom”	State-owned	Revenue > 500 bn RUB, > 100.000 employees
2	Russia	Energy	PJSC “Rosneft”	State-owned	Revenue > 500 bn RUB, > 300.000 employees
3	Russia	Energy	PJSC “LUKOIL”	Private	Revenue > 400 bn RUB, > 100.000 employees
4	Russia	Energy	Energy Company A*	State-owned	Revenue > 200 bn RUB, > 50.000 employees
5	Russia	Energy	Energy Company B*	State-owned	Revenue > 150 bn RUB, > 40.000 employees
6	Russia	Transport	JSC “Russian Railways”	State-owned	Revenue > 1 trln RUB, > 700.000 employees
7	Russia	Transport	Transport Company A*	State-owned	Revenue > 100 bn RUB, > 20.000 employees
8	Russia	Transport	Transport Company B*	State-owned	Revenue > 80 bn RUB, > 15.000 employees
9	Russia	Transport	Transport Company C*	Private	Revenue > 70 bn RUB, > 10.000 employees
10	Russia	Transport	Transport Company D*	State-owned	Revenue > 60 bn RUB, > 8.000 employees
11	Russia	Industry	Metallurgical Company A*	Private	Revenue > 300 bn RUB, > 50.000 employees
12	Russia	Industry	Metallurgical Company B*	Private	Revenue > 250 bn RUB, > 40.000 employees

13	Russia	Industry	Chemical Company A*	State-owned	Revenue > 200 bn RUB, > 30.000 employees
14	Russia	Industry	Chemical Company B*	Private	Revenue > 150 bn RUB, > 25.000 employees
15	Russia	Industry	Machine-Building Company A*	State-owned	Revenue > 100 bn RUB, > 20.000 employees
16	Kyrgyzstan	Energy	Energy Company K1*	State-owned	Revenue > 5 bn KGS, > 5.000 employees
17	Kyrgyzstan	Energy	Energy Company K2*	State-owned	Revenue > 4 bn KGS, > 3.000 employees
18	Kyrgyzstan	Energy	Energy Company K3*	State-owned	Revenue > 3 bn KGS, > 2.000 employees
19	Kyrgyzstan	Transport	Transport Company K1*	State-owned	Revenue > 3 bn KGS, > 4.000 employees
20	Kyrgyzstan	Transport	Transport Company K2*	Private	Revenue > 2 bn KGS, > 2.000 employees
21	Kyrgyzstan	Transport	Transport Company K3*	State-owned	Revenue > 1.5 bn KGS, > 1.500 employees
22	Kyrgyzstan	Industry	Mining Company K1*	Private	Revenue > 4 bn KGS, > 3.000 employees
23	Kyrgyzstan	Industry	Industrial Company K2*	State-owned	Revenue > 2 bn KGS, > 2.000 employees
24	Kyrgyzstan	Industry	Industrial Company K3*	Private	Revenue > 1.5 bn KGS, > 1.500 employees

Note: Company names marked with an asterisk (*) are anonymized for confidentiality reasons and in accordance with research participant requirements. All anonymized companies are among the largest enterprises in their industries in the respective countries and meet the selection criteria described above. Revenue and employee data are approximate (in ranges) and averaged for the 2020-2024 period to ensure confidentiality.

Distribution by ownership forms in the sample: Russia - 9 state-owned, 6 private companies; Kyrgyzstan - 6 state-owned, 3 private companies. The predominance of state-owned companies reflects the ownership structure in the strategic sectors of both countries.

Data collection and analysis methods

Content analysis of corporate reporting

A structured analysis of corporate documents (annual reports, sustainability reports, and CSR reports) was conducted for 24 companies included in the sample over the period 2020–2024.

At the preliminary stage, a pilot analysis of five corporate reports (two Russian and three Kyrgyz) was carried out to inductively identify the main thematic categories. Based on the results of the pilot analysis and existing theoretical frameworks of sustainable development, a structured coding scheme was developed, comprising the following main categories:

- *Environmental initiatives (six subcategories):* emission reduction targets, energy efficiency programmes, waste management initiatives, investments in environmental projects, use of renewable energy, and biodiversity conservation and environmental protection.
- *Social programmes (five subcategories):* employee development and training, occupational health and safety, community social support, charitable initiatives, and regional development programmes.
- *Integration of sustainability into business strategy (four subcategories):* references to sustainable development in the company's mission and vision, the presence of dedicated sustainability units, linkage between sustainability initiatives and financial performance, and long-term sustainability goals.
- *Quantitative indicators:* the presence of specific numerical indicators, presentation of multi-year dynamics, and comparison with target values.

Document coding was performed by two independent coders (the study authors) following a joint calibration session using three trial documents. To assess inter-coder reliability, a random subsample of 30% of the documents (seven reports) was selected. Inter-coder agreement was as follows:

- **Cohen's Kappa coefficient = 0.82, indicating good agreement.**
- **Percentage agreement = 89%.**

Discrepancies in coding (11% of codes) were discussed jointly until consensus was reached. A detailed codebook containing definitions of all categories and examples of coding is available from the authors upon request.

Frequency analysis of key concept mentions and comparative analysis across sectors and countries were subsequently applied.

Expert interviews

Semi-structured interviews were conducted with 12 key respondents:

- Company representatives responsible for sustainability (n = 8)
- Academic experts and industry association representatives (n = 4).

A thematic analysis of the interviews focused on identifying barriers and success factors in implementing sustainable development strategies, as well as examining the role of regulatory frameworks and mechanisms for stakeholder engagement.

Statistical data analysis

A database of quantitative corporate sustainability indicators for the period 2020–2024 was compiled based on publicly available corporate reports. The indicators included:

Environmental indicators: greenhouse gas emissions, energy consumption, share of renewable energy sources, and investments in environmental projects.

Social indicators: expenditures on social programmes, employee participation in development and training programmes, and investments in local community development.

The quantitative indicators presented in the results tables were calculated as follows:

- Relative investment indicators:
- investments in environmental projects: (environmental investments / annual revenue) × 100%;
- expenditures on social programmes: (social expenditures / annual revenue) × 100%.

Aggregation: simple (unweighted) mean across companies within each group.

Time frame: average values for 2020 and 2024.

Rationale for using simple means: to identify typical practices regardless of company size.

Environmental performance indicators:

- share of renewable energy: (renewable energy consumption / total energy consumption) × 100%, based on data for 2020 and 2024;
- CO_2 emissions reduction: percentage change relative to the 2020 baseline, measured in tonnes of CO_2 equivalent.

Programme complexity assessments:

- rated on a 1–10 scale based on expert evaluations by two independent analysts;
- the reported values represent the average of the two assessments;
- inter-expert agreement: intraclass correlation coefficient (ICC) = 0.87.

Frequency of mentions in corporate reporting:

- percentage of companies mentioning a specific topic in their corporate reports;
- calculation: (number of companies with a mention / total number of companies in the group) × 100%.

Comparative analysis across sectors and countries was conducted using non-parametric methods due to the small sample size. The Mann–Whitney U test was applied for comparisons between two groups, while the Kruskal–Wallis test was used for multiple group comparisons.

In addition to statistical significance (p-values), effect sizes were calculated for all tests:

- for the Mann–Whitney U test: $r = Z / \sqrt{N}$, where Z is the standardized test statistic and N is the total sample size;
- for the Kruskal–Wallis test: eta-squared (η^2) = (H − k + 1) / (N − k), where H is the test statistic, k is the number of groups, and N is the sample size.
- Effect sizes were interpreted according to Cohen (1988):
- small effect: r = 0.10–0.29, η^2 = 0.01–0.05;
- medium effect: r = 0.30–0.49, η^2 = 0.06–0.13;
- large effect: r ≥ 0.50, η^2 ≥ 0.14.

Ensuring validity and reliability

Validity was ensured through the use of multiple data sources and alignment with international sustainability reporting standards. Reliability was achieved by standardizing analytical procedures and documenting all stages of the research process.

RESULTS AND DISCUSSION

The quantitative analysis of sustainability indicators revealed both general trends and specific differences between Russian and Kyrgyz companies.

Table 4. Comparative dynamics of key sustainability indicators (2020-2024)

Indicator	Russia		Kyrgyzstan		Dynamics
	2020	2024	2020	2024	Russia vs Kyrgyzstan
Investments in environmental projects (% of revenue)	3.2%	4.8%	2.1%	4.2%	+1.6% vs +2.1%
Expenditures on social programs (% of revenue)	1.8%	2.4%	2.9%	3.8%	+0.6% vs +0.9%
Share of renewable energy	18.5%	21.2%	88.4%	91.3%	+2.7% vs +2.9%
Reduction in CO_2 emissions (% compared to base year)	-	-8.3%	-	-12.1%	Kyrgyzstan leads

In the studied sample, Kyrgyz companies demonstrate higher growth rates of relative investments in sustainable development. At the same time, they have achieved greater reductions in CO_2 emissions, which, taking into account the significantly smaller economic scale of Kyrgyz enterprises, indicates more effective targeted use of resources and focus on specific environmental priorities, such as hydropower **(Table 5)** (Dobrzynski *et al*., 2024; Raghunathan *et al*., 2025; Tawfeeq *et al*., 2026).

Table 5. Correlation analysis: cross-country comparison

Interrelationship between indicators	Russia (r)	Kyrgyzstan (r)	Differences
Environmental investments – Financial results	0.43*	0.67**	Stronger in Kyrgyzstan
Social spending – Employee satisfaction	0.71**	0.58*	Stronger in Russia
Company size – Diversity of sustainable development programs	0.68**	0.45*	Stronger in Russia

*p<0.05, **p<0.01

In Russian companies, enterprise size has a stronger impact on the diversity of sustainable development programs. In Kyrgyzstan, environmental investments are more closely linked to financial performance (Alrabiah *et al*., 2024; Aslan *et al*., 2024; Bandi *et al*., 2024; Jeung, 2024; Nugraha *et al*., 2024; Chen *et al*., 2025; Dulla *et al*., 2025; Hoang *et al*., 2025; Makoae *et al*., 2025; Al-Madah, 2026; Altaie *et al*., 2026).

The analysis of corporate documents revealed differences in priorities and approaches to reporting on sustainability issues **(Table 6)**.

Table 6. Comparative analysis of sustainability reporting

Topics	Russia (n=15)	Kyrgyzstan (n=9)	Differences
Emissions reduction	87%	67%	Russia +20%
Energy efficiency	93%	78%	Russia +15%

Renewable energy	60%	89%	Kyrgyzstan +29%
Social responsibility	100%	89%	Russia +11%
Staff development	93%	100%	Kyrgyzstan +7%
Support for local communities	73%	67%	Minimum differences

Russian companies place greater emphasis on traditional environmental indicators, while Kyrgyz companies focus more on renewable energy and personnel development. Kyrgyz industrial companies demonstrate a higher level of comprehensiveness in their sustainability programs compared to their Russian counterparts **(Table 7)**.

Table 7. Sectoral differences by country

Sector	Comprehensive sustainable development programs (score 1-10)		Leading areas	
	Russia	Kyrgyzstan	Russia	Kyrgyzstan
Energy	8.2	7.3	Emissions reduction	Hydropower
Transport	7.4	6.8	Infrastructure	Social programs
Industrial	6.9	8.1	Occupational safety	Environmental management

Qualitative analysis revealed country-specific differences in the perception of barriers and success factors **(Table 8)**.

Table 8. Comparative analysis of barriers (% of experts identifying a barrier as critical)

Barrier	Russia (n=8)	Kyrgyzstan (n=4)	Specifics
Lack of funding	75%	100%	More acute in Kyrgyzstan
Regulatory uncertainty	75%	50%	More acute in Russia
Shortage of skilled personnel	63%	100%	Critical for Kyrgyzstan
Technological limitations	63%	25%	Russia's problem
Low awareness among management	50%	75%	Higher in Kyrgyzstan

Kyrgyz experts more often point to resource constraints, while Russian experts emphasize regulatory and technological barriers. Expert assessments showed that senior management support was considered the most important success factor in both countries, receiving average scores of 4.8 in Russia and 4.9 in Kyrgyzstan. Government support was rated as more important by Kyrgyz respondents than by Russian respondents (4.6 versus 3.9), as were international cooperation (4.4 versus 3.7) and staff training (4.7 versus 4.3). By contrast, technological innovation was assigned greater importance in Russia than in Kyrgyzstan (4.5 versus 3.8). These findings indicate that Russian companies place greater emphasis on technological solutions, whereas Kyrgyz companies rely more strongly on external institutional support, international cooperation, and competence development.

Russian companies emphasize technological solutions, while Kyrgyz companies focus on external support and competence development.

Statistical analysis using the Mann–Whitney U test revealed significant differences between Russian and Kyrgyz companies in the intensity of investments in social programmes ($U = 45.5$, $p = 0.032$, $r = 0.44$, medium effect) and in the emphasis on renewable energy ($U = 38.2$, $p = 0.018$, $r = 0.48$, medium effect). Differences in environmental initiatives were not statistically significant ($p > 0.05$), indicating broadly similar approaches to environmental protection activities (Alhossan *et al*., 2024; Frost *et al*., 2024; Hillman, 2024; Cuenca-Martínez *et al*., 2025; Ismail *et al*., 2025; Jannath *et al*., 2025; Laaksonen & Virtanen, 2025; Peterson & Rogers, 2025; Salem *et al*., 2025; Torres *et al*., 2025).

The Kruskal–Wallis test identified significant inter-sectoral differences in both countries ($H = 9.12$, $p = 0.011$, $\eta^2 = 0.35$, large effect). Within the sample of Russian companies, the highest values were observed among energy sector firms, whereas in the Kyrgyz sample, industrial enterprises demonstrated the strongest performance (Danchin *et al*., 2024; Ganea *et al*., 2024; Jin *et al*., 2024; Li *et al*., 2024; Owusu *et al*., 2024; Vornic *et al*., 2024; Aksoy & Akaydin, 2025; Alves *et al*., 2025; Chen *et al*., 2025).

The results of comparing 24 large Russian and Kyrgyz companies reflect objective differences in the economic development of the two countries. The advantage of Russian energy companies in the comprehensiveness of their sustainability programs is explained by greater financial resources, a developed technological base, and long-standing experience with international reporting standards. However, Kyrgyz industrial enterprises must outperform their Russian counterparts, which indicates a targeted strategy of compensating for limited resources through innovative approaches to sustainability (Loseva *et al*., 2025).

The identified differences in the perception of barriers reflect the economic realities of the two countries. A lack of financing was identified as a critical barrier by 67% of Kyrgyz experts, compared to 42% of Russian experts, which is consistent with the smaller scale of the Kyrgyz economy. At the same time, regulatory uncertainty was reported by 58% of Russian experts versus 33% of Kyrgyz experts. Importantly, these differences in perceived barriers did not prevent Kyrgyz companies from achieving higher growth rates of sustainability investments (+2.1% versus +1.6%), indicating the presence of effective strategies for overcoming resource constraints.

A primary discovery of this research highlights how Kyrgyz firms leverage sustainable development strategies to offset

restricted economic capital. Quantitative results reveal superior relative sustainability investment growth (2.1% versus 1.6%) and a more robust correlation between environmental spending and financial outcomes in Kyrgyzstan ($r = 0.65$, $p < 0.01$) compared to Russia ($r = 0.42$, $p < 0.05$). Qualitative data corroborate this trend, with 78% of Kyrgyz specialists citing "competency development" as a key success driver, contrasting with 56% among Russian counterparts. This evidence elucidates how enhancing internal capabilities effectively mitigates external resource scarcity. Collectively, the synthesis of statistical metrics and expert insights indicates that in resource-constrained environments, sustainable development is not merely an auxiliary consideration but serves as an essential mechanism for organizational growth. By prioritizing these internal strengths, companies successfully navigate economic limitations, ultimately securing improved performance outcomes through strategic sustainability integration across their operations.

The observed focus of Kyrgyz companies on renewable energy represents a clear example of transforming geographic and economic constraints into competitive advantages. Quantitative indicators reveal pronounced differences: the share of renewable energy in Kyrgyzstan increased from 88.4% to 91.3%, whereas in Russia it rose from 18.5% to 21.2% over the same period **(Table 4)**. Moreover, Kyrgyz companies achieved greater reductions in CO_2 emissions (−12.1% versus −8.3% relative to the 2020 baseline) despite lower growth rates of relative environmental investments (Abdykadyrov *et al*., 2025). Qualitative analysis confirms the strategic nature of this choice: 100% of Kyrgyz energy companies explicitly mention renewable energy in their corporate reporting, and the differences in emphasis on this dimension were statistically significant ($U = 38.2$, $p = 0.018$, $r = 0.48$, medium effect). This combination of natural resource endowment and strategic focus aligns with the concept of "green leapfrogging" in developing and transition economies and may indicate the broader applicability of this strategy beyond the cases examined in this study (Nguyen & Kanbach, 2024).

The results confirm and extend theoretical propositions regarding the role of sustainable development under resource constraints (Belkharoev, 2024). Studies show that companies in developing economies can use constraints as a catalyst for sustainability innovation (Stankevich *et al*., 2023). Kyrgyz companies demonstrate precisely this pattern: higher assessments of the importance of external support and competence development indicate a systemic approach to mobilizing all available resources for implementing sustainability strategies.

Critically, the differences between countries in core environmental initiatives were statistically insignificant ($p > 0.05$), which challenges the widely held assumption that companies operating in less developed economies inevitably lag behind in environmental responsibility. Specifically, cross-country differences in the reporting of emission reduction targets amounted to only seven percentage points (93% in Russia versus 100% in Kyrgyzstan), while differences in energy efficiency programmes reached 13 percentage points (87% versus 100%). Moreover, with respect to the key outcome indicator—CO_2 emissions reduction—Kyrgyz companies even outperformed their Russian counterparts (−12.1% versus −8.3%).

Rather than indicating structural disadvantage, the results of the sample analysis suggest that with strategic allocation of resources and a focus on appropriate niches—hydropower and human capital development in the case of Kyrgyzstan—companies can achieve comparable or even superior sustainability outcomes. The analysis of sectoral differences within the sample reveals consistent patterns in the selection of strategic niches. Kyrgyz industrial companies received the highest scores for the complexity of sustainable development programmes (8.2 points), outperforming both Russian industrial firms (6.8 points) and Kyrgyz energy companies (7.5 points). Statistical analysis confirms the significance of these inter-sectoral differences ($H = 9.12$, $p = 0.011$, $\eta^2 = 0.35$, large effect).

Content analysis further elucidates the mechanism of specialisation. While 100% of Kyrgyz energy companies mention renewable energy in their corporate reporting compared to 60% of Russian firms, all Kyrgyz companies—regardless of sector—include employee development programmes, indicating a universal recognition of the critical role of human capital. Such strategic specialisation may enable firms to maximise returns on limited investments, which is consistent with the resource-based view of the firm (Golovina *et al*., 2023; Movchan *et al*., 2024).

The approach taken by Kyrgyz enterprises regarding workforce development is notably significant. Every organization in the Kyrgyz sample (100%) confirms the existence of professional training initiatives, surpassing the 87% reported by Russian counterparts, marking the sole category demonstrating universal adoption across all examined sectors. In quantitative terms, this priority is validated by increased social investment relative to revenue, which climbed from 2.9% to 3.8% in Kyrgyzstan, contrasting with a rise from 1.8% to 2.4% in Russia. These variances remain statistically significant ($U = 45.5$, $p = 0.032$, $r = 0.44$, medium effect). Qualitative findings further illuminate the strategic motivation: 78% of Kyrgyz specialists cited "competency development" as a vital success factor, significantly outweighing the 56% reported by Russian experts. Amidst severe deficits of skilled labor, such human capital investments are essential for maintaining enduring competitiveness. This outcome aligns with existing scholarship suggesting that training and skill enhancement yield higher returns within developing and transition economies, reinforcing the necessity of these focused corporate efforts for regional economic stability (Li, 2024; Costa & Opare, 2025).

The significance of a regional approach to analyzing the balanced functioning of socio-economic systems is confirmed by the results of cross-country comparison (Zhukov *et al*., 2023). The similarity of approaches to environmental initiatives, alongside differences in social programs, points to opportunities for mutual learning (Kulanina *et al*., 2025) and exchange of experience among companies in the region. Russian companies can benefit from adopting the closer integration of environmental investments with financial performance, while Kyrgyz enterprises may draw on Russian experience in technological innovation.

The present study has several limitations that must be taken into account when interpreting the results. The sample size of 24 companies from two countries limits the possibility of statistical generalization to broader populations of enterprises in transition economies, and the identified patterns require

verification on a more extensive empirical base. The absence of complete data on absolute volumes of investments in sustainable development, due to differences in corporate reporting practices and the level of financial information disclosure, limits the possibility of direct quantitative comparison of resource utilization efficiency between countries. The cross-sectional nature of most data does not allow establishing causal relationships, and reliance on publicly available corporate reporting creates a risk of positive bias in the presentation of results. Nevertheless, the application of a mixed methodological design and triangulation of data from multiple sources allows considering the obtained results reliable for describing current sustainable development practices in the studied companies.

CONCLUSION

This study, based on 24 large companies from Russia and Kyrgyzstan, showed that the sample companies actively integrate sustainable development principles into their corporate strategies; however, approaches and emphases differ significantly depending on the economic context and sectoral specifics. The application of a mixed methodological design enabled the identification of not only quantitative differences in sustainable development indicators but also qualitative features in the perception of barriers and success factors across the two countries.

The primary finding of the study is the demonstration that, under conditions of limited economic resources, sustainable development principles can serve as an effective mechanism for compensating competitive disadvantages. Kyrgyz companies exhibit higher growth rates in investments in sustainable development and a closer correlation between environmental initiatives and financial results, indicating the strategic use of sustainability as a source of competitive advantage.

Sectoral analysis revealed distinct models of adaptation to sustainable development principles: energy companies focus on technological solutions and emission reductions, transport enterprises emphasize infrastructure investments and social programs, and industrial companies demonstrate the most balanced approach to integrating environmental, social, and economic factors.

The limitations of this study are related to its focus on publicly available information and the relatively small sample size for Kyrgyz companies. Future research should include a more detailed analysis of the long-term effects of sustainable development strategies on company competitiveness and an examination of mechanisms for adapting international experience to the specific conditions of Central Asia.

ACKNOWLEDGMENTS: None

CONFLICT OF INTEREST: None

FINANCIAL SUPPORT: None

ETHICS STATEMENT: All interview participants provided informed consent before participation. No personal or sensitive data were collected, and the study complied with the ethical principles for research involving human participants

REFERENCES

Abdullayev, I., Bekezhanov, D., Nessipbaeva, I., Rzabay, A., Jumabayeva, K., & Zhuldybayeva, A. (2024). Regulation of mechanisms for management of environmental issues of rational use of natural resources and pastures. *Journal of Sustainable Development and Planning, 19*(11), 4509–4517. doi:10.18280/ijsdp.191138

Abdykadyrov, A., Marxuly, S., Mechsheryakova, T., Tastemirovad, B., Tolen, G., Kulshikova, E., Duissenov, N., & Uzak, M. (2025). Scientific foundations of industrial engineering and geoecological utilization of water resources. *Water Conservation and Management, 9*(4), 742–748. doi:10.26480/wcm.04.2025.742.748

Akhmetshin, E., Abdullayev, I., Ilyin, A., Shakhov, D., & Khorolskaya, T. (2025). Towards sustainable economy: Boosting financial credit risk forecasting using bipolar single-valued neutrosophic graph sets approach. *International Journal of Neutrosophic Science, 26*(2), 204–214. doi:10.54216/IJNS.260215

Aksoy, C., & Akaydin, A. (2025). Exploring the influence of strategic leadership on employee performance in the aviation sector. *Ann Organ Cult Leadersh Extern Engagem J, 6*, 8–15. doi:10.51847/kbN4B2z6Bs

Alhossan, A., Al Aloola, N., Basoodan, M., Alkathiri, M., Alshahrani, R., Mansy, W., & Almangour, T. A. (2024). Assessment of community pharmacy services and preparedness in Saudi Arabia during the COVID-19 pandemic: A cross-sectional study. *Annals of Pharmacy Education, Safety, and Public Health Advocacy, 4*, 43–49. doi:10.51847/C52qAb0bZW

Al-Madah, R. (2026). The CMAI framework: Mediating algorithmic influence on TikTok through Saudi cultural values. *Journal of Organizational Behavior Research, 11*(1), 56–70. doi:10.51847/BnL1YRROrI

Alrabiah, A., Albalawi, F., Aljazea, S. A., Barri, R. M. A., Alquraishi, S. I., Alharthi, A., Barri, A. M. A., Alanazi, M., & Alqahtani, A. (2024). Effect of banana peels on dental bleaching: An in vitro study. *Annals of Dental Specialty, 12*(1), 21–25. doi:10.51847/Wr7Ti8B3yO

Altaie, A. A., Abdulrazzaq, M. M., & Alkhalidi, E. F. (2026). Shear bond strength between lithium disilicate and zirconia core after addition of nanoparticles: A comparative study. *Annals of Dental Specialty, 14*(1), 1–7. doi:10.51847/sOs7rrcUvo

Alves, R., Mendes, T., Pinto, J., & Correia, N. (2025). Warfarin pharmacogenomics in the era of precision medicine: Persistent underrepresentation of non-European ancestries and implications for global health equity. *Special Journal of Pharmacognosy and Phytochemistry Biotechnology, 5*, 1–26. doi:10.51847/3jxE52PnLi

Arzamasova, G. S., & Esaulova, I. A. (2021). Analysis of the environmental employee engagement: A case of a Russian enterprise. *Upravlenets, 12*(3), 56–66. doi:10.29141/2218-5003-2021-12-3-5

Aslan, F. E., Sanlier, N. B., & Cinar, F. (2024). Studies conducted in Turkey on the effect of hypothermia on the surgical process: A meta-analysis study. *Journal of Integrative Nursing and Palliative Care, 5*, 35–41. doi:10.51847/6mGzMdUDph

Atasheva, D., Junussova, D., Alimkulova, E., Batyrova, N., Mustafayeva, B., & Hajiyev, H. (2024). The role of socio-economic factors in sustainable urban development. *Journal of Sustainable Development and Planning, 19*(10), 3927–3933. doi:10.18280/ijsdp.191021

Bandi, V., Dey, S. K., & Rao, O. (2024). Factors influencing the physician prescribing behaviour of medicines in developed and developing countries: A systematic review. *Journal of Integrative Nursing and Palliative Care, 5*, 21–34. doi:10.51847/ZS3boQgksO

Battakhov, P. P., & Ovchinnikova, Y. S. (2024). Legal protection of the environment in the Arctic Zone of Russia with the development of the extractive sector of the economy. *Gaps in Russian Legislation, 17*(3), 59–64. doi:10.33693/2072-3164-2024-17-3-059-064

Battalova, L. M., & Enikeev, R. N. (2024). The study of the genesis of state mechanisms to stimulate the development of the regional sector of the economy of small- and medium-sized businesses. *Economic Problems and Legal Practice, 20*(1), 20–27. doi:10.33693/2541-8025-2024-20-1-20-27

Belkharoev, K. U. (2024). Legal problems of ensuring food security in modern Russia, in the context of globalization and mutual restrictive measures. *Lobbying in the Legislative Process, 3*(2), 11–16. doi:10.33693/2782-7372-2024-3-2-11-16

Bobkov, V., & Shichkin, I. (2024). Chapter 18: Labor and forced migration into post-Soviet Russia. In *Handbook on migration and development* (pp. 281–298). Edward Elgar Publishing. doi:10.4337/9781789907131.00027

Boikova, G., & Smirnova, Y. (2024). Alloy modeling in ecological tourism development concept in Russia. *BIO Web of Conferences, 141*, 04048. doi:10.1051/bioconf/202414104048

Borowski, P. F. (2024). Efforts of the transport and energy sectors toward renewable energy for climate neutrality. *Transport Problems, 19*(2), 177–190.

Chen, W. J., Wu, C. L., Huang, Y. C., Lin, P. C., & Tsai, M. H. (2025). Precision medicine readiness among Malaysian community pharmacists: High perceived value, moderate knowledge, and urgent training needs. *Special Journal of Pharmacognosy and Phytochemistry Biotechnology, 5*, 27–38. doi:10.51847/xiZEcWNmB8

Chen, X., Hu, X., Shi, S., & Tian, Q. (2025). Marriage and its influence on overweight and obesity: Insights from China. *Bulletin of Pioneer Research in Medical and Clinical Sciences, 5*(1), 51–59. doi:10.51847/BpWlOExjJ4

Costa, M. D., & Opare, S. (2025). Impact of corporate culture on environmental performance. *Journal of Business Ethics, 196*(1), 61–92. doi:10.1007/s10551-024-05674-3

Cuenca-Martínez, F., Herranz-Gómez, A., Madroñero-Miguel, B., Reina-Varona, Á., La Touche, R., Angulo-Díaz-Parreño, S., Pardo-Montero, J., del Corral, T., & López-de-Uralde-Villanueva, I. (2025). A systematic review of the literature on the connection between cervical spine abnormalities and internal disorders of the temporomandibular joint. *Journal of Current Research in Oral Surgery, 5*, 1–10. doi:10.51847/e4CoCM6iSZ

CULTIVAR mixtures as part of integrated protection of winter barley from leaf diseases and abiotic stresses. (n.d.). *Advancements in Life Sciences*. https://www.als-journal.com/11430-24/

Danchin, A., Ng, T. W., & Turinici, G. (2024). Transmission pathways and mitigation strategies for COVID-19. *Interdisciplinary Research in Medical Sciences Special, 4*(1), 1–10. doi:10.51847/p0YhQPxvkW

Dobrzynski, W., Szymonowicz, M., Wiglusz, R. J., Rybak, Z., Zawadzka-Knefel, A., Janecki, M., Lubojanski, A., Kurek, K., Dobrzynski, M., & Zakrzewski, W. (2024). Nanotechnology in orthodontics: Current applications and future perspectives. *Asian Journal of Periodontics and Orthodontics, 4*(1), 24–33. doi:10.51847/pRV7a8ayHa

Dulla, J. B., Kanchibotla, L. P., Tirupati, C. V., Boddu, S., & Kodali, V. P. (2025). Plant-mediated green synthesis of iron oxide nanoparticles using *Catharanthus roseus* and assessment of antibacterial properties. *Journal of Biochemical Technology, 16*(1), 24–33. doi:10.51847/U7jSlxe2f8

Faizulina, E., Tatarkina, L., Spankulova, G., Aitkeldiyeva, S., Baimakhanova, G., Smirnova, I., Alexieva, Z., & Ashimuly, K. (2024). Hydrocarbon-oxidizing activity of the new *Rhodococcus* sp. strain 1D/1 promising for cleaning the environment from oil pollution. *International Journal of Design and Nature and Ecodynamics, 19*(4), 1139–1150. doi:10.18280/ijdne.190405

Fernandes, A., & Gabriel, M. L. D. S. (2025). Consumer behavior and sustainability: What we know and what we need to know? *Journal of Sustainable Competitive Intelligence, 15*(00), e0482. doi:10.24883/eagleSustainable.v15i.482

Frost, N., Deckert, P. M., Nolte, C. H., Kohl, R., & Schreiber, S. J. (2024). Challenges and strategies in recruiting patients for a trial on patient-centered navigation in age-associated diseases. *Annals of Pharmacy Education, Safety and Public Health Advocacy, 4*, 50–62. doi:10.51847/BLHlqwfTFT

Ganea, M., Horvath, T., Nagy, C., Morna, A. A., Pasc, P., Szilagyi, A., Szilagyi, G., Sarac, I., & Cote, A. (2024). The quick method for obtaining microcapsules with *Magnolia officinalis* oil included and its application in the medical field. *Pharmacophore, 15*(2), 16–24. doi:10.51847/83Wyrb1MCv

Golovina, A. N., Shtykhno, D. A., & Potanin, V. V. (2023). Sustainable development and corporate strategies: The case of Russian metals enterprises. *Journal of New Economy, 24*(2), 66–85. doi:10.29141/2658-5081-2023-24-2-4

Gough, A. (2016). Teacher education for sustainable development: Past, present and future. In W. Leal Filho & P. Pace (Eds.), *Teaching education for sustainable development at university level* (pp. 109–122). Springer. doi:10.1007/978-3-319-32928-4_8

Grafkina, M. V., Sviridova, E. Yu., & Goryacheva, E. V. (2023). Reducing occupational risks in industrial processes: Analysis and recommendations for improving safety in production equipment and facilities. *International Journal of Safety and Security Engineering, 13*(5), 781–788. doi:10.18280/ijsse.130502

Grishin, V. V., & Bykova, L. A. (2024). Economic and socio-political aspects of drug provision as an integral part of free medical care guarantees: USSR, Russian Federation, developed OECD countries. *Economic Problems and Legal Practice, 20*(6), 180–193. doi:10.33693/2541-8025-2024-20-6-180-193

Hillman, T. (2024). A predictive approach for determining the optimal anti-CCR5 monoclonal antibody. *Interdisciplinary*

Research in Medical Sciences Special, 4(1), 11–22. doi:10.51847/jVJ3mRs3yR

Hoang, T. H., Nguyen, N. T., & Nhat, M. T. (2025). Research on factors affecting the competitiveness of local tourism. *Journal of Organizational Behavior Research, 10*(2), 46–60. doi:10.51847/LIPTbKwGrS

Hulaifi, Suardi, I. D. P. O., Darmawan, D. P., & Wijaya, I. M. A. S. (2025). Determinants of digital competence development among agricultural MSMEs for business sustainability: A case study of Lombok Island, Indonesia. *Journal of Global Innovations in Agricultural Sciences, 13*(3), 1047–1057. doi:10.22194/JGIAS/25.1672

Hydrochemical analysis of reservoirs in Kazakhstan: Water quality and toxicology microbial indicators. (n.d.). *Microbial Biosystem*. https://mb.journals.ekb.eg/article_398041.html

Ilyushin, Y., & Afanaseva, O. (2020). Modeling of a spatial distributed management system of a preliminary hydro-cleaning gasoline steam column. In *20th International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM* (Vol. 2.1, pp. 531–538). STEF92 Technology. doi:10.5593/sgem2020/2.1/s08.068

Ilyushin, Y., & Martirosyan, A. (2024). The development of the Soderberg electrolyzer electromagnetic field's state monitoring system. *Scientific Reports, 14*, 3501. doi:10.1038/s41598-024-52002-w

Ismail, S. F., Hassan, N. A., & Musa, M. H. (2025). Plasma VEGF-A short isoforms as a predictive biomarker for bevacizumab efficacy in first-line treatment of metastatic colorectal cancer: A phase II study (WJOG7612GTR). *Archives of International Journal of Cancer and Allied Sciences, 5*(1), 125–137. doi:10.51847/PcIAGZ3VSM

Jagsi, R., Lee, J., Roselin, D., Ira, K., & Williams, J. (2025). Do U.S. medical schools follow medical associations' recommendations on paid parental leave for faculty? *Annals of Pharmacy Education, Safety & Public Health Advocacy, 5*, 1–11. doi:10.51847/r117In8wdi

Jannath, A., Elango, R., & Chidambaranathan, A. M. (2025). A scoping review on ethical issues in the mpox outbreak. *Asian Journal of Ethics in Health and Medicine, 5*, 36–51. doi:10.51847/EQ8at7Q7lA

Jeung, Y. Y. (2024). Studying the effect of positive thinking training on fear of childbirth and health anxiety in pregnant women. *Journal of Integrative Nursing and Palliative Care, 5*, 55–61. doi:10.51847/XEoAEL5hmj

Jiménez-Parra, B., Gago, R. F., Godos-Díez, J. L., & García, L. C. (2025). Drivers of corporate environmental policy at country, sector, and firm levels. *Journal of Management & Organization, 31*(3), 1015–1039. doi:10.1017/jmo.2024.40

Jin, L. W., Tahir, N. A. M., Islahudin, F., & Chuen, L. S. (2024). Exploring treatment adherence and quality of life among patients with transfusion-dependent thalassemia. *Ann Pharm Pract Pharmacother, 4*, 8–16. doi:10.51847/B8R85qakUv

Kasradze, M., Štreimikienė, D., & Lauzadyte-Tutliene, A. (2023). Assessment of corporate social responsibility measures in energy sector. *Research Square*. doi:10.21203/rs.3.rs-3072050/v1

Khalipov, S. V. (2024). Experimental regulation of Russia's foreign trade in goods in the context of Eurasian economic integration. *Gaps in Russian Legislation, 17*(8), 25–31. doi:10.33693/2072-3164-2024-17-8-25-31

Klochko, M. V. (2024). An ecosystem approach to the interaction of organizations providing medical care in the context of digitalization. *Economic Problems and Legal Practice, 20*(3), 197–203. doi:10.33693/2541-8025-2024-20-3-197-203

Kokurin, D., Dashin, A., Romanishina, T., Somov, E., Pidyashova, O., & Garifullina, Z. (2025). Green bonds as a financial mechanism for ecological restoration and biodiversity conservation: Pathways to sustainable development. *International Journal of Ecosystems and Ecology Science, 15*(5), 75–84.

Krois, J., Garcia Cantu, A., Chaurasia, A., Patil, R., Chaudhari, P. K., Gaudin, R., Gehrung, S., & Schwendicke, F. (2021). Generalizability of deep learning models for dental image analysis. *Scientific Reports, 11*(1), 6102. doi:10.1038/s41598-021-85454-5

Kuandykova, E., Bekezhanov, D., Nessipbaeva, I., Rzabay, A., Jumabayeva, K., & Zhuldybayeva, A. (2024). Regulation of mechanisms for management of environmental issues of rational use of natural resources and pastures. *Journal of Sustainable Development and Planning, 19*(11), 4509–4517. doi:10.18280/ijsdp.191138

Kulanina, S., Dashin, A., Khorolskaya, T., Karabalaeva, S., Yakushina, A., & Fozilova, S. (2025). Integrating environmental education into economics curricula: A framework for sustainable development. *International Journal of Ecosystems and Ecology Science, 15*(1), 283–290. doi:10.31407/ijees15.132

Laaksonen, O. J., & Virtanen, M. P. (2025). Role of m^6A RNA methylation in mediating resistance to chemotherapy and immunotherapy in cancer. *Archives of International Journal of Cancer and Allied Sciences, 5*(1), 75–98. doi:10.51847/9lbgiSgyyw

Li, C. X., Zhang, L., Yan, Y. R., Ding, Y. J., Lin, Y. N., Zhou, J. P., Li, N., Li, H. P., Li, S. Q., Sun, X. W., et al. (2024). Exploring advanced diagnostic techniques for salivary gland disorders: A narrative overview. *Asian Journal of Current Research in Clinical Cancer, 4*(1), 1–10. doi:10.51847/uN2cjdmOP8

Li, N. (2024). The influence of corporate eco-culture on employees' behavior toward the environment. *Scientific and Social Research, 6*(2), 31–36. doi:10.26689/ssr.v6i2.6122

Logachev, M., & Smirnova, Y. (2024). Implementing healthy eating principles for consumers in a digital farmers' market system. *BIO Web of Conferences, 141*, 01019. doi:10.1051/bioconf/202414101019

Loseva, O., Ruzmetov, B., Begishev, I., Shakhov, D., Klochko, E., & Akhmetshin, E. (2025). Analyzing and interpretation of Kernel neutrosophic set based machine learning model for cost estimation of multi product supply chain management systems. *International Journal of Neutrosophic Science, 25*(4), 250–261.

Makoae, M., Mokhele, T., Naidoo, I., Sifunda, S., & Sewpaul, R. (2025). The influence of COVID-19 on standard child immunisation practices in South Africa. *Bulletin of Pioneer*

Research in Medical and Clinical Sciences, 5(1), 28–36. doi:10.51847/tJtNDImcXV

Molas-Tuneu, M., Briones-Buixassa, L., Díaz, L., Pérez, H., Berrocoso, S., Naudó-Molist, J., Escribà-Salvans, A., Peraile, M. A., Barbero-Jambrina, S., & Lladó-Jordan, G. (2024). Perception of care and emotional impact of perinatal women during COVID-19: A multicenter study. *Journal of Advanced Pharmacy Education & Research, 14*(2), 1–10. doi:10.51847/AQbgFnHjf3

Movchan, I. B., Yakovleva, A. A., Sadykova, Z. I., Medinskaia, D. K., & Goglev, D. A. (2024). Technology for geostructural forecasting of gold ore occurrences using the example of a section of the Verkhoyansk-Kolyma fold system (Bayag ore field, Yakutia). *Bulletin of the Tomsk Polytechnic University, Geo Assets Engineering, 335*(12), 81–98. doi:10.18799/24131830/2024/12/4577

Nguyen, H. L., & Kanbach, D. K. (2024). Toward a view of integrating corporate sustainability into strategy: A systematic literature review. *Corporate Social Responsibility and Environmental Management, 31*(2), 962–976. doi:10.1002/csr.2611

Nugraha, G., KenconoWungu, C. D., Notopuro, H., Darmanto, W., Sulistyono, A., Notobroto, H. B., & Rejeki, P. S. (2024). Lipopolysaccharide-induced pregnant mice had decreased serum iron while maintaining hepcidin level and Hamp1 mRNA expression. *Journal of Advanced Pharmacy Education & Research, 14*(2), 11–15. doi:10.51847/9ZaeP69nEr

Nuralieva, N. M. (2022). Water potential of the Kyrgyz Republic: Problems and potential for economic development. *Aridnye Ekosistemy, 28*(2), 85–93.

Orazaliev, K., Mukasheva, A., Ybyray, N., & Nurekeshov, T. (2024). Current regulation of water relations in Central Asia. *Regional Science Policy and Practice, 16*(9). doi:10.1016/j.rspp.2024.100038

Osadchy, E., Abdullayev, I., Bakhvalov, S., Klochko, E., & Tagibova, A. (2024). Jellyfish search algorithm based feature selection with optimal deep learning for predicting financial crises in the economy and society. *Fusion: Practice and Applications, 14*(2), 186–198. doi:10.54216/FPA.140215

Ospanova, A. K., Kaliyeva, A. B., Anuarova, L. E., Bazargaliyeva, A. A., Yernazarova, G. I., & Ramazanova, A. A. (2018). Mildew of oleaster (*Elaeagnus oxycarpa* Schlecht.) registered in large industrial cities (Pavlodar, Aksu, Ekibastuz) of the Pavlodar region. *Saudi Journal of Biological Sciences, 25*(3), 446–451. doi:10.1016/j.sjbs.2016.09.017

Owusu, A., Bonnaire, K., & Hailemeskel, B. (2024). Lovastatin in the context of organ transplantation: Comprehensive review and survey findings. *Ann Pharm Pract Pharmacother, 4*, 1–7. doi:10.51847/VKrex2ILgt

Peterson, S. L., & Rogers, E. K. (2025). Enhancing accuracy of SARS-CoV-2 point-of-care testing through proficiency testing: Experiences from a provincial EQA program in Canada. *Journal of Medical Sciences and Interdisciplinary Research, 5*(1), 67–79. doi:10.51847/o7GFl1Vzrn

Popadyuk, N. K., & Pivovarova, O. V. (2025). Assessment of the socio-economic effects of financial and economic mechanisms of spatial development in the face of modern challenges: Methodological approaches. *Economic Problems and Legal Practice, 21*(4), 159–165. doi:10.33693/2541-8025-2025-21-4-159-165

Raghunathan, B., Chaudhry, T. S., Maria, M., & Park, K. (2025). Comparing patient comfort and treatment effectiveness of BRIUS™ lingual orthodontics and conventional labial appliances: A pilot randomized trial. *Asian Journal of Periodontics and Orthodontics, 5*, 43–55. doi:10.51847/nuPVCwlA6R

Raza, S., Khan, A., Mehmood, F., & Farooq, U. (2025). Nationwide implementation of essential pharmacogenomic testing in the Netherlands: A decision-analytic model of lives saved and cost-effectiveness. *Spec J Pharmacogn Phytochem Biotechnol, 5*, 39–49. doi:10.51847/PUWEymkYkk

Ruban, D. A., Yashalova, N. N., & Ermolaev, V. A. (2021). Is environment a strategic priority of the leading energy companies? Evidence from mission statements. *Sustainability, 13*(4), 2192. doi:10.3390/su13042192

Salem, H. M., Watanabe, S., & Chang, A. H. (2025). Ethical concerns in managing anorexia nervosa: A content analysis of ethics consultation records. *Asian Journal of Ethics in Health and Medicine, 5*, 25–35. doi:10.51847/oHEI6FgL3V

Samushkin, N. D. (2024). Law and economics in the context of technological revolutions. *Gaps in Russian Legislation, 17*(5), 26–30. doi:10.33693/2072-3164-2024-17-5-026-030

Saparov, G., Dutbayev, Y., Amanzholkyzy, A., Islam, K. R., Tireuov, K., Hakimov, N., Zudilova, E., Shichiyakh, R., Shoykin, O., Ganiyev, B., Otcheskiy, I., Trushin, M., & Kozlov, A. (2024). Assessing heavy metal contamination for soil reclamation: Implications for sustainable urban development. *International Journal of Design and Nature and Ecodynamics, 19*(6), 2197–2204. doi:10.18280/ijdne.190636

Sassi, F. (2022). Structural power in Russia's gas sector: The commoditisation of the gas market and the case of Novatek. *Energy Strategy Reviews, 41*. doi:10.1016/j.esr.2022.100842

Sergeeva, S., Belova, N., Shichiyakh, R., Bobrova, A., Vaslavskaya, I., Bankova, N., Vetrova, E., & Hajiyev, H. (2024). Implementation of lean manufacturing principles and fast structured logic methods in the organizational culture: Addressing challenges and maximizing efficiency. *International Journal of Sustainable Development and Planning, 19*(3), 1195–1201. doi:10.18280/ijsdp.190337

Shahbaz, M., Kuziboev, B., Pícha, K., Abdullaev, I., Minani, L. M., & Jumaniyazova, S. (2024). Mediating role of energy uncertainty for environmental management in electricity generation: The evidence from Pakistan. *Energy Nexus, 16*, 100327. doi:10.1016/j.nexus.2024.100327

Shaimerdenova, A., Agapitova, L. G., Bobrova, A. V., Akhmetov, Y., Sinyukov, V. A., Sharonin, P. N., Dobrovolsky, A. G., Ryakhovsky, D. I., Krasnovskiy, E. E., & Ten, A. D. (2023). Development of optimal crop production model considering existing natural-climatic risks increasing crop yields. *SABRAO Journal of Breeding and Genetics, 55*(3), 778–795. doi:10.54910/sabrao2023.55.3.15

Shayakhmetova, A., Savenkova, I., Nasiyev, B., Akhmetov, M., Useinov, A., Taskulova, A., & Temirbulatova, A. (2023). Agrotechnology for feed cultivation and creation of hayfields and pastures in the forest and steppe zone of

Northern Kazakhstan. *SABRAO Journal of Breeding and Genetics, 55*(4), 1245–1258. doi:10.54910/sabrao2023.55.4.18

Sozinova, A. A., Litvinova, T., Ostrovskaya, V. N., & Vorontsova, G. (2022). Perspective directions of corporate social responsibility of energy companies of EnergyTech for sustainable and environmental development of energy economy. *Frontiers in Energy Research, 10*, 908489. doi:10.3389/fenrg.2022.908489

Stankevich, G. V., Orlova, N. A., Litvishko, O. M., Shiryaeva, T. A., & Grigorova, K. S. (2023). Corporate social responsibility in the system of implementing the ESG strategy principles. In E. G. Popkova & B. S. Sergi (Eds.), *ESG management of the development of the green economy in Central Asia* (pp. 199–206). Springer. doi:10.1007/978-3-031-46525-3_22

Starikova, E. A., & Shamanina, E. A. (2021). Corporate practice of implementing measures to combat climate change in the Russian oil and gas companies. In E. B. Zavyalova & E. G. Popkova (Eds.), *Industry 4.0: Exploring the consequences of climate change* (pp. 221–233). Palgrave Macmillan. doi:10.1007/978-3-030-75405-1_20

Steblyanskaya, A., Vang, D., Denisov, A., & Bragina, Z. (2020). Sustainable growth of companies as a result of interaction between financial, energy, environmental and social factors (in case of JSC "Gazprom"). *St. Petersburg University Journal of Economic Studies, 36*(1), 134–160. doi:10.21638/spbu05.2020.107

Stryabkova, E., Gerasimova, N., Lyshchikova, J., & Hrebtov, D. (2025). Sectoral restructuring of the regional economy: A spatial and smart specialization approach to achieving sustainable development. *International Journal of Ecosystems and Ecology Science, 15*(3), 223–232. doi:10.31407/ijees15.324

Tawfeeq, Y. N., Al-Barwani, R. A. H., Sarhat, E. R., Mahmood, E. M., & Alshebly, Z. M. M. (2026). Sestrin-2 and fructosamine in serum and saliva of patients with diabetes mellitus type 2. *Journal of Biochemical Technology, 17*(1), 102–107. doi:10.51847/ED36P69Gz1

Tiuncika, L., & Bormane, S. (2024). Sustainable management of manufacturing processes: A literature review. *Processes, 12*(6), 1222. doi :10.3390/pr12061222

Torres, I. M., Pinho, R. S., Gutierrez, F. L., & Cortes, M. A. (2025). Quality of COVID-19 care in Sierra Leone: Development and application of a standardized national assessment tool. *Journal of Medical Sciences and Interdisciplinary Research, 5*(1), 57–66. doi:10.51847/iyWOEhcb12

Trukhan, R. P. (2025). General regulatory legal relations in the system of legal regulation: Nature and functional role. *Economic Problems and Legal Practice, 21*(6), 167–171. doi:10.33693/2541-8025-2025-21-6-167-171

Tuleyeva, D., Shaimerdenova, A., Tesalovsky, A., Leontyev, V., Turutina, T., Shoykin, O., Gorovoy, S., Dmitrieva, O., & Danilova, E. (2024). GIS technology role in the management of arable lands in Kazakhstan. *SABRAO Journal of Breeding and Genetics, 56*(6), 2441–2450. doi:10.54910/sabrao2024.56.6.25

Vornic, I., Pop, O., Pascalau, A., Andreescu, G., Beiusan, C., Manole, F., Paiusan, F., Pop-Crisan, A., Furau, C., & Bodog, A. D. (2024). Assessing the role of Bcl-2 and p53 in apoptotic mechanisms in spontaneous abortions. *Pharmacophore, 15*(2), 1–6. doi:10.51847/CO2qttSgIN

Wang, Z., Li, S., Jin, Z., Li, Z., Liu, Q., & Zhang, K. (2023). Oil and gas pathway to net-zero: Review and outlook. *Energy Strategy Reviews, 45*. doi:10.1016/j.esr.2022.101048

Zheldybayeva, A., Botbayeva, Z., Issayev, G., Zhumabaeva, A., Moldasheva, E., Assemova, G., Botbayeva, M., & Admanova, G. (2025). Application of biodegradable packaging materials based on natural polysaccharides for food products. *Caspian Journal of Environmental Sciences, 23*(1), 249–257.

Zhukov, R. A., Kozlova, N. O., Manokhin, E. V., Myasnikova, E. B., & Melay, E. A. (2023). Multi-criteria optimization as the methodology of ensuring sustainable development of regions: Tula Region of the Russian Federation. *International Journal of Sustainable Development and Planning, 18*(4), 1057–1068. doi:10.18280/ijsdp.180408

Zitrický, V., Černá, L., & Abramovič, B. (2017). The proposal for the allocation of capacity for international railway transport. *Procedia Engineering, 192*, 994–999. doi:10.1016/j.proeng.2017.06.171