



ANALYSIS OF SUSTAINABLE DEVELOPMENT FACTORS IN THE REPUBLIC OF SRPSKA IN THE CONTEXT OF THE REGIONAL ENVIRONMENT

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Abstract

Sustainable development in the Republic of Srpska is shaped by the interaction of demographic, economic, social, technological, environmental, and institutional factors. The aim of this research is to identify the most important factors affecting sustainability, determine the direction of their changes, and assess the development risks that may characterize the period up to 2030, based on available official statistical data. The analysis is primarily based on sustainable development indicators published by the Republika Srpska Institute of Statistics, supplemented by data from statistical yearbooks and thematic publications. For selected indicators, comparisons were made with Serbia, Federation of Bosnia and Herzegovina, Montenegro and Croatia.

The results indicate an uneven development pattern. Significant progress has been achieved in reducing unemployment, increasing the use of information and communication technologies, and improving certain health indicators. The financial sector demonstrates relative stability, while nominal investment in research and development is increasing. At the same time, the Republic of Srpska is facing a continuous population decline and negative natural population growth, while expenditure on research and development remains low relative to GDP. Environmental infrastructure capacities are limited, and the energy sector and parts of industry continue to exhibit relatively high emissions intensity.

Keywords: sustainable development, Republic of Srpska, Agenda 2030, development, research, climate change, CBAM

1. INTRODUCTION

Sustainable development is a concept in which the economic, social, and environmental dimensions of development are viewed as interdependent elements. The United Nations 2030 Agenda organizes the sustainable development framework around 17 goals and 169 targets, with indicators used to measure changes in the economy, society, and the environment. The Republic of Srpska Institute of Statistics organizes the available data in accordance with the global SDG framework and the corresponding European Union indicators [1]. Long-term sustainability also depends on the size and structure of the population, the quality of the workforce, innovation capacity, the

availability of natural resources, emissions, infrastructure, healthcare, education, and the institutional capacity to plan and monitor development policies.

The Republic of Srpska Institute of Statistics emphasizes that the system of sustainable development indicators should provide a basis for analysis and policy development in the areas of quality of life, health, education, climate change, gender equality, and institutional efficiency [1].

A particular reason for an integrated analysis is the fact that certain positive trends in the Republic of Srpska are occurring in parallel with unfavorable structural changes. For example, unemployment is significantly lower than it was ten years ago, while at the same time the population and the available workforce are declining. Digital accessibility is increasing rapidly, but investment in research and development remains low. The energy sector represents an important development resource, but its emissions structure increases exposure to European climate policy. The aim of this research is to analyze the most important factors of sustainable development in the Republic of Srpska, identify positive and negative trends, compare selected indicators with neighboring countries, assess key development risks, and define priorities for a more sustainable development pattern up to 2030.

2. METHODS

The primary data sources are the publications Sustainable Development Indicators of the Republic of Srpska 2022 and Sustainable Development Indicators of the Republic of Srpska 2024, which cover indicators related to all 17 Sustainable Development Goals. The 2024 publication includes economic, social, environmental, and institutional indicators and draws on data from the Republika Srpska Institute of Statistics and other competent institutions of the Republic of Srpska [1,2]. The analysis is based on time-series analysis, comparison of initial and most recent available values, regional comparison of selected indicators, analysis of interdependencies among factors, and qualitative assessment of development risks.

The observation period is not uniform across all indicators. A large number of data series cover the period 2009-2023, emissions data currently extend only to 2022 in the publication, while certain social indicators, including detailed poverty indicators, refer to considerably earlier reference years. This represents an important limitation of the analysis. The lack of more recent data is not only a methodological constraint for the research, but also a limitation of the sustainable development governance system.

3. RESULTS AND DISCUSSION

3.1. Demographic sustainability

The demographic component represents the most significant long-term constraint on the sustainable development of the Republic of Srpska. The estimated population declined from 1,157,516 in 2016 to 1,110,496 in 2024. This means that over an eight-year period, the estimated population decreased by approximately 47,000 people, or about 4.1%. The official data series of the Republic of Srpska Institute of Statistics shows a continuous decline in every year of the observed period [3]. At the same time, natural population growth remained negative throughout the entire period. In 2016, the

natural population change amounted to -4,518, in 2020 to -7,421, and in 2021 it reached as low as -9,728. Following the pandemic period, the negative balance moderated, but it did not turn positive. Natural population growth amounted to -4,199 in 2023 and -4,909 in 2024 [4]. The demographic problem is not the result of a short-term disturbance. Even when the exceptionally unfavorable year of 2021 is excluded, the underlying trend remains negative.

3.2. Human capital, health and quality of life

In contrast to demographic indicators, certain health indicators show long-term improvement. Life expectancy increased from 75.3 years in 2009 to 78.9 years in 2023. For men, it increased from 72.6 to 76.0 years, while for women it rose from 78.0 to 81.7 years. At the same time, the mortality rate of children under five decreased from 5.5 to 3.3 per 1,000 live births, while the neonatal mortality rate declined from 3.8 to 1.9 per 1,000 live births [1]. The pandemic temporarily interrupted the positive trend in life expectancy. In 2021, the value fell to approximately the level recorded in 2009, but a relatively rapid recovery followed after the pandemic period. [2]. In the field of education, the results are less clear-cut. The share of people aged 30–34 with tertiary education increased over the previous decade, but declined from 33.6% in 2022 to 28.1% in 2023. In 2023, this share was 35.4% among women and 21.5% among men [1].

These data should be interpreted with caution due to the sample size, but they point to two important trends. The Republic of Srpska has significantly increased participation in higher education compared with the beginning of the observed period. At the same time, there is a risk that youth migration and changes in the demographic structure of younger generations may affect the availability of highly educated people.

3.3. Labour market

The most pronounced positive development trend was recorded in the labour market. The unemployment rate increased from 21.4% in 2009 to a peak of 27.0% in 2013. It then began to decline sharply. In 2019, the unemployment rate stood at 11.7%, followed by 14.3% in 2021, 11.2% in 2022, and only 9.1% in 2023 [1,4].

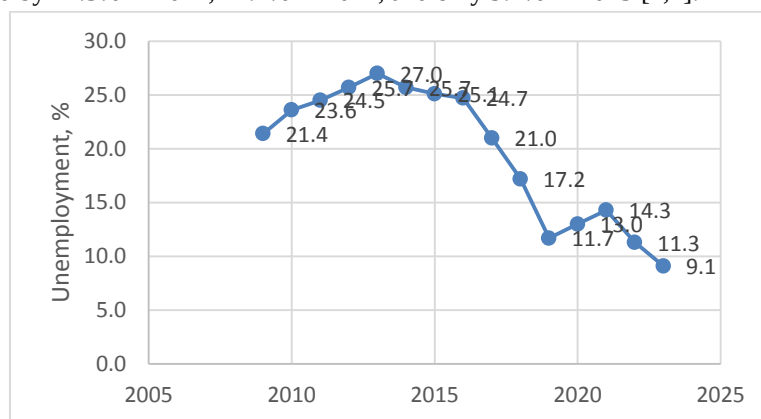


Figure 1. Unemployment rate in the Republic of Srpska, 2009-2023. Source: Institute of Statistics RS

However, interpreting these results requires considering them together with demographic indicators. The decline in unemployment has occurred alongside a reduction in the total population and the working-age population. Therefore, part of the decrease in unemployment reflects genuine growth in employment and economic activity, while another part results from a shrinking labour supply. In the coming period, the main labour market challenge will probably no longer be high unemployment, but rather a shortage of appropriately skilled workers. A comparison with the Republic of Serbia shows that, according to this indicator, the Republic of Srpska is aligned to the regional level. In Serbia, the unemployment rate in the fourth quarter of 2023 was approximately 9.1%, while in 2024 it remained around 9% or slightly below, depending on the quarter [5]. In 2023, the unemployment rate was 15.0% in the Federation of Bosnia and Herzegovina [6] and 13.1% in Montenegro [7], both above the 9.1% recorded in the Republic of Srpska. This indicates a relatively more favorable labour-market position of the Republic of Srpska, although the age coverage of the surveys is not completely identical.

3.4. Industry and production

Industry, and manufacturing in particular, plays an important role in the economy of the Republic of Srpska and is one of the key sources of exports, employment, and technological development. The share of manufacturing gross value added in GDP increased from 9.3% in 2009 to 11.8% in 2023 [4]. However, the structure of industry is more important than its share alone. An industrial sector that relies predominantly on coal-based energy, lower value-added products, price competitiveness, or high consumption of energy and materials faces substantially higher development risks than an industry based on knowledge, energy efficiency, automation, and technologically more complex products. For these reasons, sustainable industrialization in the Republic of Srpska should mean increasing value added per employee or per unit of energy consumed, rather than merely increasing the physical volume of production.

3.5. Research, development and innovations

Research and development represent one of the weakest components of the system analyzed. Total expenditure on research and development amounted to BAM 24.6 million in 2009 and increased to BAM 49.0 million in 2013, after which it declined significantly. In 2021, R&D expenditure amounted to BAM 25.4 million, increasing to BAM 30.8 million in 2022 and BAM 38.9 million in 2023. [4]. The nominal increase recorded in recent years is a positive development. However, the issue becomes clearer when R&D expenditure is considered as a share of GDP.

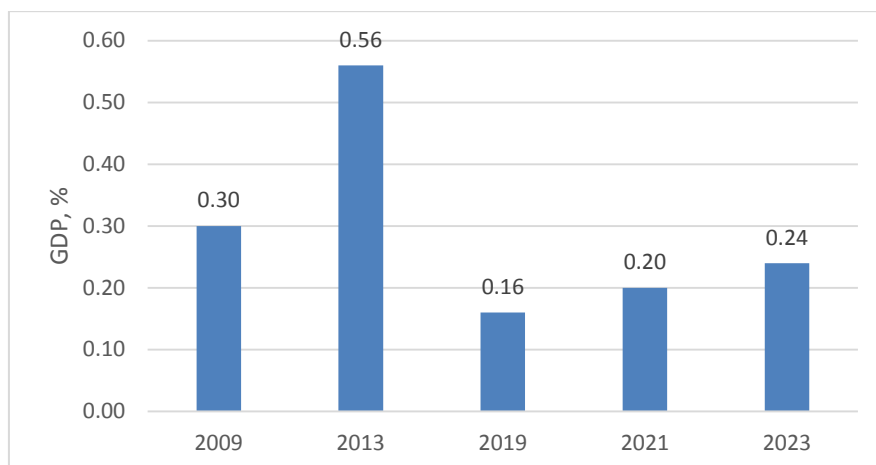


Figure 2. Research and development expenditure as a share of GDP in the Republic of Srpska, selected years. Source: Institute of Statistics RS

The share amounted to approximately 0.30% of GDP in 2009, 0.56% in 2013, 0.16% in 2019, around 0.20% in 2021, and 0.24% in 2023 [2, 4]. The figure of 0.24% of GDP represents a serious constraint for an economy that needs to undergo digital, energy, and industrial transformation simultaneously. For comparison, Croatia provides a useful indication of the size of this gap. In 2023, Croatia allocated 1.39% of its GDP to research and development [8]. This means that the relative intensity of investment in research and development in Croatia is almost six times higher than in the Republic of Srpska. Of course, this indicator does not automatically imply that every euro invested in research is used efficiently. However, in the long term, it is difficult to expect significant improvements in productivity, the technological complexity of products, and competitiveness with R&D expenditure of only about one-quarter of one percent of GDP. A medium-term objective of increasing R&D expenditure to at least 0.5% of GDP would therefore represent a realistic first step, provided that most of the additional funding is linked to specific industrial, energy, healthcare, and digital projects. Particular attention should be given to improving the capacity to access EU funding and participate successfully in advanced EU programmes and projects, including Horizon Europe and similar initiatives.

3.6. Digitalisation

Digitalization represents one of the areas in which the fastest progress has been achieved. The share of people aged 16-74 who use the internet increased from approximately 38% in 2014 to 86.9% in 2023. The gap between urban and other settlements has narrowed considerably, with internet usage reaching 90.0% among residents of urban areas and 84.9% among residents of other settlements [1]. However, significant differences remain by age and educational attainment. Internet use is nearly

universal among people aged 16-24, while it declines considerably among those aged 65 and over. Among people with tertiary education, internet use reaches 98.6%, compared with 61.4% among those with less than upper-secondary education [1]. This indicates that the first phase of digitalization, namely access to the internet, has largely been achieved. In 2024, 83.3% of individuals aged 16-74 in the Federation of Bosnia and Herzegovina [9] and 88.9% in Montenegro [10] used the internet during the previous three months. Compared with 86.9% in the Republic of Srpska in 2023, these results place the Republic of Srpska between the two comparators and confirm that basic digital access is one of its relatively stronger development factors.

3.7. Climate change and emissions

Greenhouse gas emissions represent one of the key environmental and economic indicators. In 2018, total emissions excluding removals amounted to 9,969.9 Gg CO₂-eq, while in 2022 they decreased to 9,297.3 Gg CO₂-eq [4].

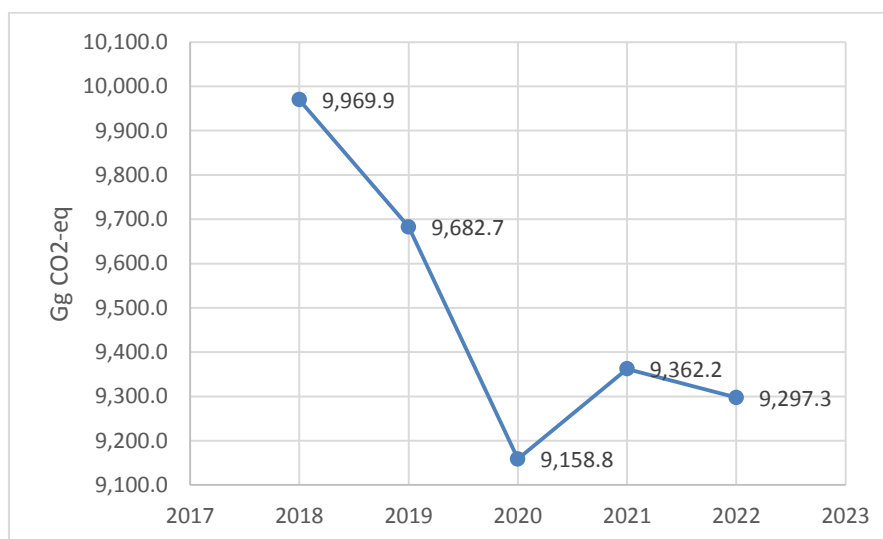


Figure 3. Total greenhouse gas (GHG) emissions excluding removals, 2018-2022.

Source: Institute of Statistics RS.

Compared with 2018, emissions in 2022 were approximately 6.7% lower. This trend is favorable, but it does not yet provide sufficient evidence of structural decarbonization. The decline recorded in 2020 was significantly associated with reduced economic activity during the pandemic, after which emissions increased again. The emissions structure shows the dominant role of CO₂. In 2022, CO₂ emissions amounted to approximately 7,409 Gg CO₂-eq, methane emissions to 975.6 Gg CO₂-eq, and N₂O emissions to 912.7 Gg CO₂-eq [1].



The definitive CBAM regime entered into application on 1 January 2026. EU importers of products covered by the mechanism are subject to obligations related to reporting embedded emissions and surrendering the corresponding CBAM certificates [11]. For Bosnia and Herzegovina, and consequently the Republic of Srpska, electricity is of particular importance. Even before the start of the definitive regime, the Energy Community Secretariat warned that electricity exports from Bosnia and Herzegovina to the EU would become exposed to CBAM-related costs unless appropriate market integration and the development of a domestic carbon pricing system were achieved. The first data from 2026 indicate that the impact is already becoming visible in the regional market. According to the Energy Community Secretariat, commercial cross-border flows between the Western Balkans and the EU declined by approximately 25% in the first quarter of 2026, while electricity prices in the markets of the Contracting Parties were, on average, around EUR 30/MWh lower than in neighboring EU markets. The Secretariat links these developments to the implementation of CBAM and the resulting changes in electricity trade flows [12]. This represents a significant change in the development environment of the Republic of Srpska. Until 2025, CO₂ emissions largely represented an environmental indicator and a future regulatory risk. From 2026 onward, they are increasingly becoming a market-related factor. For industry, this means that competitiveness will also depend on:

- emissions per unit of product,
- the origin of electricity,
- the quality of emissions accounting systems,
- energy efficiency,
- the ability to shift to renewable energy sources,
- the capacity of suppliers to provide EU customers with verifiable emissions data.

Therefore, CBAM directly links Sustainable Development Goals (SDGs) 7, 9, 12, and 13 with the export competitiveness of the economy.

3.8. Water, waste and infrastructure

The volume of treated municipal wastewater increased from 1.084 million m³ in 2010 to 4.047 million m³ in 2023. However, the share of the population connected to systems providing at least secondary treatment was only 4.7% in 2023. This indicates a clear gap between local investments and overall system coverage. The existence of individual treatment facilities and the increase in the volume of treated wastewater represent progress, but total coverage remains very limited. Further investment is particularly needed in larger urban areas and river basins where concentrations of population and industry create the greatest pressure on the environment and natural receiving waters. A similar problem exists in waste management. According to the available data series, the total amount of waste generated, excluding major mineral waste, has increased, although the Republic of Srpska Institute of Statistics notes that changes in methodological coverage limit direct comparability over the entire period [1]. The key development objective should therefore be to move from a system whose primary function is waste collection and disposal toward a system based on waste



prevention, separate collection, reuse, recycling, energy or other forms of recovery, and minimal disposal.

According to the available comparable indicator, 31.39% of the population in Croatia was connected to wastewater treatment systems providing at least secondary treatment, while the corresponding share in the Republic of Srpska was 4.7% in 2023. In 2023, Croatia recycled 36% of its municipal waste [6]. The definitions and coverage of waste management systems are not fully identical, so direct ranking is not methodologically justified. Nevertheless, the difference clearly indicates the need for substantially greater investment in municipal and circular economy infrastructure in the Republic of Srpska. Regional comparison therefore does not indicate that the Republic of Srpska lags uniformly across all areas. For example, its results are competitive in terms of basic digital access and the current unemployment rate. The largest gaps are found in areas that will shape future competitiveness, particularly research and development, technological transformation, human capital, decarbonization, and environmental infrastructure.

4. CONCLUSION

The analysis shows that sustainable development in the Republic of Srpska has a highly uneven structure. The labour market, digitalization, and certain health indicators have recorded progress. The financial system is more stable, while nominal investment in research and development is increasing. However, these improvements are taking place alongside a long-term population decline, low research intensity, limited environmental infrastructure, and significant emissions exposure in the energy and industrial sectors. The conclusion is that sustainability cannot be built solely on growth in production volumes or declining unemployment. Under conditions of depopulation and decarbonization, productivity, the technological context of production, the quality of human capital, the efficiency of energy and resource use, and the capacity of institutions to measure results in a timely manner become critical. Regional comparison confirms that the Republic of Srpska does not lag significantly in terms of basic digital access and unemployment, but that substantial gaps remain in research and development and environmental infrastructure. CBAM further accelerates the need to integrate climate policy with industrial, energy, and export policies. The priority up to 2030 should therefore be a coordinated transition, with particular emphasis on demographic stabilization and human capital. Measures should be linked to housing policy, education, employment growth, healthcare, and policies encouraging population return. Investment in research and development should be increased and directed toward projects that connect businesses, universities, and the public sector.

In the field of energy efficiency, reliable emissions measurement is essential, while renewable energy sources and modernization of the electricity grid are becoming important conditions for export competitiveness. Regarding municipal and circular economy infrastructure, priorities should include secondary wastewater treatment, separate waste collection, recycling, and reducing waste disposal.



The next stage of development must be considerably more demanding, focusing on the use of digital technologies to increase productivity. Priorities should include automation and robotization, real-time production management, digital monitoring of energy and material consumption, e-commerce, the application of data analytics and AI, interoperable electronic public services, and related solutions.

At the same time, greater attention should be paid to the quality and monitoring of data. Indicators should be regularly updated, linked to measurable targets, and analyzed transparently.

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