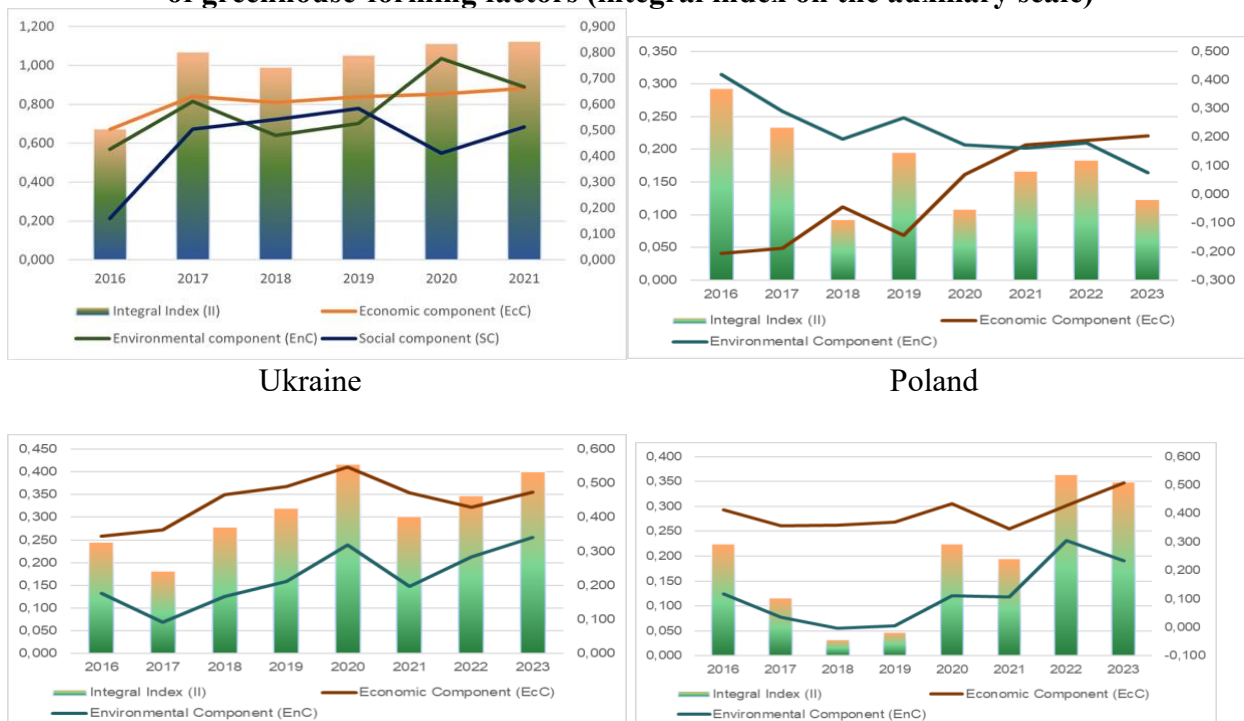


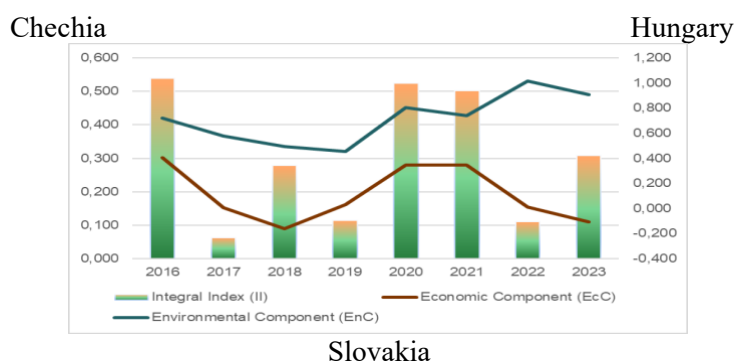
METHODOLOGICAL ASSESSMENT OF FACTORS INFLUENCING GREENHOUSE GAS EMISSIONS IN UKRAINE AND THE VISEGRÁD COUNTRIES

Carbon dioxide emissions are the largest contributor to greenhouse gas emissions. This is a global trend. The producers of these emissions are comparable both at the global and European levels and at the local level (households and enterprises of all economic activities). Nevertheless, the majority of carbon dioxide emissions into the atmosphere are generated by the economic activities of thermal power plants and processing industry enterprises. In Europe, the largest greenhouse gas emissions typically come from industries and regions with high energy use, strong industrial activity, or dependence on fossil fuels. As part of the Visegrád project on «Forecasting Factors Influencing Climate Change as Part of the Sustainable Development Goals 2030» the project participants developed a methodology for the integral assessment of the potential to reduce greenhouse gas emissions in Ukraine and the Visegrád countries. This study underscores the complexity and multifaceted nature of greenhouse gas (GHG) emissions, emphasizing the interconnected influence of economic, environmental, and social factors on their formation and dynamics. The integral methodology developed and applied within the research provides a robust framework for evaluating these influences, particularly within the context of Ukraine and the Visegrád countries.

The assessment of greenhouse gas emissions potential is based on a conceptual view of emissions as a composite (aggregate) result of the interrelated impact of economic, social, and environmental factors. At the same time, due to the challenges of using a similar statistical base to Ukrainian statistics (especially in terms of social indicators), the assessment was conducted in economic and environmental components, based on the maximum similarity of the selected indicators. Weighting factors were calculated based on the Coefficient of variation of the component. The practical significance of the proposed methodology lies in its ability to identify the direction of the combined behavior of all local influencing factors on greenhouse gas volumes.

Dynamics of the integral index and local components of greenhouse-forming factors (integral index on the auxiliary scale)





Slovakia

The calculation of the integral index for assessing greenhouse-forming factors shows an increase in the negative factor impact on greenhouse gas emissions both in Ukraine in 2016-2021 and in the Visegrad countries in 2016-2023. This conclusion indicates the need to intensify decisions directed at decarbonizing the economic activities of business entities and households.

The correlation analysis of local components and the integral index allowed us to identify a group of factors that have the greatest impact on the dynamics between the integral index and the greenhouse-forming factors.

Correlation analysis of the influence the local components on the integral index

| Local components | The correlation coefficient of local components with the integral index | | | | |
|-------------------------------|---|--------|---------|---------|----------|
| | Ukraine | Poland | Hungary | Czechia | Slovakia |
| Economic component (EcC) | 0.995 | 0.688 | 0.779 | 0.803 | 0.980 |
| Environmental component (EnC) | 0.762 | 0.846 | 0.971 | 0.970 | 0.212 |
| Social component (SC) | 0.833 | - | - | - | - |

The correlation analysis indicates that the dynamics of the integral index is statistically closely linked to a combination of economic, social, and environmental indicators for Ukraine, and to economic and environmental indicators for the Visegrad countries. Furthermore, economic factors – showing the highest variability over the assessed period – exert the strongest influence on the trend of the integral behavior of the greenhouse-forming factors index, with the exception of Slovakia. Consequently, to achieve sustainable development goals, Ukraine should prioritize decarbonization efforts in the energy, metallurgy, and transportation sectors. Emissions from road transport and agriculture emerged as primary environmental contributors. The intensity of fertilizer usage and GHG emissions highlighted the critical role of sustainable agricultural practices in reducing emissions.