

Green Transition and Regional Employment Disparities in the Visegrád Countries

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The transition toward a climate-neutral, low-carbon economy is fundamentally reshaping regional economic structures and labour markets across Europe. While this transformation creates new opportunities for growth, innovation, and employment, it also carries significant risks of deepening existing territorial inequalities. The impacts of decarbonisation are uneven across regions, depending on their economic structures, human capital endowments, institutional capacity, and ability to adapt to new technological and environmental requirements.

This study examines regional employment disparities in the Visegrád countries – Czechia, Hungary, Poland, and Slovakia – at the NUTS2 level over the period 2000–2024, with particular attention to structural factors shaping regions' capacity to participate in the emerging green economy. The primary objective is to assess whether regions are equally prepared to attract and benefit from green dedicated investments (GDI), and whether the green transition is likely to contribute to territorial cohesion or, conversely, reinforce pre-existing development gaps.

The analysis is grounded in the assumption that the green transition does not occur in a spatial vacuum. Rather, it unfolds within historically shaped socio-economic structures characterized by significant regional disparities. In the Visegrád countries, these disparities are especially pronounced due to the legacy of post-socialist transformation. Since the early 1990s, economic restructuring has produced strong regional polarization: capital regions and major metropolitan areas have generally evolved into diversified, innovation-driven economies, while peripheral regions often remain dependent on traditional industries, lower-value manufacturing, or agriculture.

To capture the multidimensional nature of regional readiness for green transformation, the study links labour market performance to broader development conditions. Key factors considered include the level of human capital, innovation capacity, economic structure, infrastructure quality, and institutional effectiveness. These elements jointly determine whether a region can attract sustainable investments, develop new green industries, and ensure a smooth labour market adjustment.

Regions with highly educated workforces and strong research and development systems are better positioned to capitalize on emerging sectors such as renewable energy technologies, energy efficiency solutions, circular economy activities, and environmental services. In contrast, regions characterized by lower educational attainment, limited innovation capacity, and dependence on carbon-intensive industries face greater challenges in adapting to structural change. In such areas, the green transition may initially lead to job losses and economic disruption before new opportunities materialize.

The empirical analysis employs multivariate statistical techniques to identify distinct regional profiles. Principal component analysis is used to synthesize multiple development indicators into composite dimensions, capturing underlying patterns of socio-economic performance. Cluster analysis then groups regions with similar labour market and structural characteristics, allowing for the identification of typologies of regional development within the Visegrád space.

This approach reveals substantial heterogeneity across regions, both within and between countries. Capital regions consistently form a distinct cluster characterized by high employment rates, strong service sectors, advanced infrastructure, and significant innovation

capacity. Conversely, several peripheral and former industrial regions exhibit lower employment levels, weaker diversification, and limited absorptive capacity for new investments.

To examine the dynamics of regional disparities over time, the study applies beta and sigma convergence methods. Beta convergence assesses whether regions with lower initial employment rates tend to grow faster than more developed regions, thereby narrowing the gap. Sigma convergence measures changes in the dispersion of employment rates across regions, indicating whether inequalities are actually decreasing.

The results suggest that long-term convergence in employment levels is observable, but the process is neither linear nor stable. Convergence patterns are strongly influenced by macroeconomic cycles and external shocks. Periods of economic expansion tend to promote catch-up growth in lagging regions, while downturns often exacerbate disparities.

The global financial crisis of 2008–2009 significantly weakened convergence trends. Regions with less diversified economic structures and higher dependence on vulnerable sectors experienced deeper employment losses and slower recovery. Similarly, the COVID-19 pandemic introduced substantial instability, disrupting labour markets and disproportionately affecting structurally weaker regions. Areas heavily reliant on tourism, traditional manufacturing, or face-to-face services were particularly vulnerable, whereas regions with knowledge-intensive sectors and digital infrastructure demonstrated greater resilience.

A key finding of the study is the persistence of structural heterogeneity across the Visegrád countries. Despite overall economic growth and integration into the European Union, regional disparities remain substantial. Capital regions such as Prague, Budapest, Warsaw, and Bratislava exhibit significantly higher employment rates, productivity levels, and innovation capacity compared to many rural or industrial regions. These differences are reinforced by demographic trends, including internal migration of skilled workers toward metropolitan areas and population ageing in peripheral regions.

The spatial distribution of green investments is likely to follow existing development gradients. Investors typically prefer locations offering reliable infrastructure, skilled labour, research institutions, and stable governance frameworks. Consequently, regions that are already economically advanced are more likely to attract GDI, while less developed regions may struggle to compete. This dynamic raises concerns that the green transition could inadvertently intensify territorial inequalities.

Particularly vulnerable are regions dependent on carbon-intensive industries such as coal mining, heavy manufacturing, or energy-intensive production. In these areas, decarbonisation policies may lead to substantial job losses unless accompanied by effective transition strategies. Without targeted support, workers in these sectors may face long-term unemployment or downward occupational mobility.

The study underscores the importance of policy interventions in shaping the territorial outcomes of the green transition. Place-based policies – tailored to the specific needs and capacities of individual regions – are essential for ensuring that sustainability goals are compatible with social cohesion. Such policies may include investments in education and vocational training, support for innovation systems, infrastructure development, and strengthening of local governance capacities.

The concept of a “just transition” is particularly relevant in this context. It emphasizes that climate action should not disproportionately burden certain regions or social groups. The European Union’s Just Transition Mechanism provides financial assistance to regions most affected by the shift away from fossil fuels. However, the effectiveness of these funds depends on strategic planning, institutional quality, and the ability of local actors to design and implement viable development projects.

Beyond direct employment effects, the green transition also influences labour markets through structural change in skills demand. New green sectors often require advanced technical competencies, digital skills, and interdisciplinary knowledge. This creates both opportunities and risks: regions capable of upgrading their human capital can benefit from high-quality jobs, while those unable to adapt may experience skill mismatches and labour market exclusion.

Keywords: regional disparities; labour market; green transition; regional development; Visegrád countries; convergence