

Rural Resilience and Economic Sustainability: A Comparative Analysis of Best Practices in Romania and Bulgaria

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1. Introduction and Problem Statement

Rural territories in South-Eastern Europe, particularly in Romania and Bulgaria, face a dual challenge: systemic depopulation and the imperative transition toward the European Green Deal's carbon-neutrality goals. While these regions have traditionally relied on primary agricultural production, this model has proven insufficient for ensuring long-term economic resilience.

The motivation for this study stems from the urgent need to shift from a "subsistence-based" rural economy to a "value-added" bioeconomy. The research focuses on how local biomass and agricultural residues—often treated as waste—can be transformed into economic catalysts through structured innovation frameworks.

2. Theoretical Framework and Methodology

This paper adopts the Open Innovation Platforms (OIP) methodology, a cornerstone of the BE-Rural Project's approach to regional development. The OIP framework facilitates a "bottom-up" transition by bridging the gap between theoretical potential and commercial application. This approach shifts from traditional top-down planning to a participatory model that recognizes regions as the most effective level for bioeconomy implementation.

2.1. The Quadruple Helix and Key Performance Indicators (KPIs)

Moving beyond the traditional Triple Helix (Government-Academia-Industry) by integrating Civil Society as a key driver of social acceptance and local entrepreneurship means the building of the Quadruple Helix Model.

The methodology employs the Quadruple Helix Model, integrating administration, academia, business, and civil society. To evaluate the success of these strategies in some regions in Bulgaria and Romania, we defined a set of multidimensional KPIs:

- **Economic:** Biomass Valorization Rate (percentage of residues converted into finished products) and Farm Income Diversification.
- **Social:** Youth Retention Index (number of bioeconomy start-ups launched by entrepreneurs under 40) and Quadruple Helix Cohesion (active partnerships).
- **Environmental:** Local Carbon Footprint Reduction through fossil fuel displacement.

2.2. Regional Comparative Analysis

The comparative analysis is conducted through three methodological lenses:

SWOT Analysis of Bioeconomy Potential: Evaluating the specific biogenic resources in some regions, as for example: the Vidin region (Bulgaria) versus the Centru Region (Romania).

In this context we intend to benchmark the Bio-based Business Models, through a technical and economic comparison of active business cases, such as pellet production from agricultural residues in Bulgaria and medicinal plant processing in Romania.

2.2.1. Vidin Region (BG): Cereal Residue Valorization

In Vidin, the focus is on converting straw and cereal residues into heating pellets. The research identifies that the "burn-on-field" practice can be mitigated by creating energy cooperatives, where farmers become shareholders in production units, ensuring both raw material supply and a local market. The study examines how the integration of small-scale energy production (pellets/briquettes) can stabilize local energy costs and provide secondary income streams for farmers.

2.2.2. Centru Region (RO): Forestry and Medicinal Plants

In Romania, the focus is on the sustainable use of sawdust and bark for bio-composites, alongside the processing of aromatic plants. The study highlights that local distillation and drying centers allow mountain farmers to achieve margins 5 to 10 times higher than selling raw materials. The analysis targets forestry biomass and the untapped potential of aromatic and medicinal plants. The research highlights how local processing (distillation, drying) creates higher profit margins compared to raw material exports.

2.3. Integration of European Initiatives and Policy Frameworks

Besides BE-Rural project's results, the study evaluates the impact of several key EU programs on regional resilience:

Horizon Europe & CBE JU: Specifically looking at projects like SCALE-UP, which focuses on accelerating regional bioeconomies through social innovation and value chain expansion.

Interreg VI-A Romania-Bulgaria (2021-2027): Analyzing how cross-border cooperation funds support environmental protection and sustainable transport, which are critical for biomass logistics.

CAP Strategic Plans (2023-2027): Investigating how the approved plans for Romania and Bulgaria allocate funds for "green" investments and the setup of young farmers (e.g., €1.1 billion for processing units in Romania).

BIOEAST Initiative: Leveraging the macro-regional network's recommendations to align local strategies with Central and Eastern European bioeconomy priorities.

3. Analysis and Discussion of Results

Preliminary findings suggest that rural resilience is not a byproduct of capital intensity, but of ecosystem connectivity.

The "Knowledge Gap": Our data indicates that technological availability is rarely the primary bottleneck. Instead, a lack of specialized "bio-literacy" among local actors prevents the adoption of sustainable practices.

A central argument of this paper is that investment in technology without investment in human capital is destined for failure. Data from OIP platforms, created in BE-Rural project, indicates that "innovation brokers"—experts who translate academic research into profitable business terms for rural entrepreneurs—are the missing link. In Bulgaria, bio-literacy workshops demonstrated a 25% increase in farmers' openness to digitalization within a single project cycle.

Subsidies vs. Innovation: While CAP (Common Agricultural Policy) subsidies provide a safety net, they often disincentivize diversification. The study identifies that the most resilient communities are those that have utilized European Regional Development Funds to co-create local processing hubs.

4. Policy Recommendations

The paper concludes with a set of actionable recommendations for regional authorities:

Transition to Quadruple Helix Governance: Formally involve local NGOs and community leaders in the design of regional development roadmaps.

Investment in Human Capital: Prioritize "soft" infrastructure (workshops, technology transfer hubs) over "hard" infrastructure to ensure the long-term viability of bio-based investments.

Cross-Border Knowledge Exchange: Establish a permanent RO-BG rural innovation network to replicate successful pilot projects across the Danube.

Key Recommendations:

-Streamline Access: Facilitate CBE JU funding for rural SMEs.

-Bioeconomy Hubs: Establish regional centers providing technical and legal consultancy for young entrepreneurs.

-Legislative Reform: Standardize "End-of-Waste" status to allow agricultural residues to be easily used as industrial feedstock.

By implementing these measures, Romania and Bulgaria can transform rural peripheries into innovation hubs, aligning with the EU's 2050 climate neutrality goals.

5. Final Conclusions

The research demonstrates that the sustainable valorization of local resources is the only viable path to decoupling rural economic growth from environmental degradation. By shifting from the Triple Helix to a Quadruple Helix model, Romania and Bulgaria can transform their rural peripheries into innovative hubs that attract young entrepreneurs and align with the European Green Deal objectives.

The paper concludes that rural economic sustainability in the Balkans depends on creating Short Supply Chains. Resilience does not stem from global commodity markets, but from a community's ability to process its own resources.

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