AI-ENABLED AKIS, FAIR DATA AND CARBON-SMART FOOD SYSTEMS FOR RESILIENT RURAL–URBAN EUROPE

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AI-Enabled AKIS, FAIR Data and Carbon-Smart Food Systems for Resilient Rural–Urban Europe

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Target audience	European Commission (DG AGRI, DG REGIO, DG CONNECT, DG RTD, DG CLIMA, DG SANTE)
Origin	PoliRuralPlus Consortium (Analysis of Nine Pilot Regions & Cross-WP Findings)

Executive Summary: From Vision to Execution

PoliRuralPlus pilot actions conducted across **nine** European regions, from **County Monaghan (Ireland), Slovakia, Central Greece, Puglia (Italy), Mallusjoki (Finland), the Czech–Bavarian border region, Sierra y Mancha Conquense (Spain), Vidzeme (Latvia),** and **Malta**, affirm the strategic value of AI-enhanced Agricultural Knowledge and Innovation Systems (AKIS 4.0), FAIR-by-design rural data spaces, and localised, carbon-smart food corridors.

These regional initiatives confirm that digital tools can substantially support rural transformation in line with the European Green Deal, Digital Decade, and Long-Term Vision for Rural Areas. While digital tools played a central role in these pilots, they were deployed in support of broader transformations: such as landscape restoration, community-led food systems, eco-tourism models, and youth engagement strategies that reflect each region's socio-ecological context. However, execution has also revealed a shared operational bottleneck: the intensive human effort required to curate, structure, and translate local data into formats that large language models (LLMs) and digital tools like **JackDaw** and the **PoliRuralPlus GPT Advisor** can meaningfully process.

AI systems, though technically advanced, remain highly dependent on the quality and structure of the data they ingest. Across all pilots, the manual nature of collecting, annotating, and

contextualising rural knowledge proved a major barrier in terms of labour, time, and institutional capacity. This "hidden infrastructure" of human effort remains under-recognised in most digital policy frameworks, yet it is foundational for enabling trustworthy, inclusive, and actionable AI services in rural contexts.

Execution Challenges Observed Across Pilots

- **Labour-Intensive AI Training**: Feeding rural, multilingual, and domain-specific data into PoliRuralPlus AI systems required months of manual work: annotation, formatting, and validation. These essential efforts are rarely funded or resourced at scale. This labour is often layered atop existing responsibilities in rural innovation hubs, advisory services, or cultural associations, underscoring the need to integrate digital efforts into holistic rural development frameworks.
- **Uneven Data Literacy and Digital Capacity**: Despite the availability of digital platforms, many rural actors faced challenges in contributing due to insufficient digital skills and support structures. Moreover, digital exclusion frequently overlaps with demographic and geographic challenges (such as population ageing, weak mobility systems, and poor access to education and healthcare), highlighting the necessity of addressing ICT capacity within a wider rural inclusion agenda.
- **Complex Data Governance**: Achieving FAIR compliance across nine pilots required navigating fragmented legal frameworks, inconsistent data formats, and language-specific metadata protocols. Beyond digital governance, many regions lacked frameworks to align local food policy, landscape management, or tourism strategy with data ecosystems, pointing to a structural gap between data tools and multi-sectoral planning.
- **AI–Policy Disconnect**: While EU strategies promote AI readiness, regional stakeholders lacked access to harmonised standards for integrating LLMs into public knowledge infrastructures. This gap was especially evident in regions where AI was expected to contribute to rural depopulation strategies, sustainable land use planning, or LEADER action plans, yet lacked a recognised role within those instruments.
- **Stakeholder Fatigue**: Repeated engagement requests through dashboards, foresight platforms, and co-creation tools led to consultation fatigue in several areas, diminishing long-term participation. Consultation overload often coincided with other participatory demands (linked to Natura 2000, CAP reform, or climate adaptation planning) making it essential to streamline AI-related engagement into existing rural co-governance routines.
- **Disparate Language Ecosystems**: Tools such as JackDaw required custom linguistic tuning for diverse EU languages and dialects, necessitating expert human input for reliable translation and terminology alignment. This challenge affected not only AI systems but also policy documentation, training materials, and foresight narratives, which often lacked formal translations into local idioms or minority languages critical for cultural engagement.
- **Sectoral Limitation of Tools**: While agriculture was a focal domain, several pilots underscored the need to extend digital support to other rural services such as mobility, healthcare, education, and housing. AI applications must increasingly address rural mobility services, remote healthcare, cultural heritage management, and educational access: key domains identified across pilots where digitalisation remains underdeveloped.

STRATEGIC RECOMMENDATIONS FOR THE COMMISION

1. **Fund the Human Layer of AI**

   Recognise and resource the expert labour required to make rural data usable for AI: especially tasks like ontology alignment, contextual tagging, and metadata validation. Include a "Data Curation Line" in EU AI project budgets.

2. **AI Readiness Scores for Rural Regions**

   Establish a standard metric framework to assess regional preparedness for AI integration: capturing both digital infrastructure and human/system capacity.

3. **AI-Ready FAIR Templates**

   Provide EU-wide, domain-specific data standards and open APIs to facilitate rapid FAIR data adoption in agriculture, ecosystem services, tourism, and public administration. Templates should reflect not only sector-specific technical parameters but also thematic domains identified in regional plans, such as local food governance, energy cooperatives, and cultural programming, ensuring that digital resources align with real-world rural priorities.

4. **Multilingual AI Sandbox Funding**

   Fund fine-tuning of LLMs and digital advisors in under-resourced European languages (e.g., Maltese, Latvian, regional dialects), ensuring inclusiveness and accessibility across member states.

5. **Digital Steward Training Programme**

   Support a new category of digital professionals embedded in rural institutions: able to mediate between technical developers and local users, and foster sustainable system use.

6. **Integration of Co-Creation Platforms like MAATool**

   Ensure tools such as the Multi-Actor Approach Tool (MAATool) are embedded into AI data pipelines, so stakeholder inputs translate directly into usable system knowledge.

7. **Strengthen AKIS Integration in Digital Ecosystems**

   Facilitate stronger alignment between AI tools and Agricultural Knowledge and Innovation Systems (AKIS), involving certified advisers and knowledge hubs. AKIS entities are also well-placed to connect AI initiatives to broader missions including biodiversity conservation, vocational education, and community resilience, thereby reinforcing the multifunctional role of rural knowledge system, and vocational centres as core contributors and beneficiaries.

8. **Anchor AI in Local Innovation Infrastructures**

   Support co-location of digital services with territorial structures such as living labs, LEADER groups, or rural demonstration sites to enhance ownership, localisation, and practical deployment.

9. **Support Smart Specialisation Alignment**

   Promote digital solutions that are tailored to regional smart specialisation priorities and local ecological, demographic, and economic conditions.

10. **Use AI for Real-Time Policy Feedback**

    Deploy AI-supported dashboards to generate continuous, fine-grained policy feedback at the regional level, improving implementation responsiveness and stakeholder accountability.

Conclusion

The digital transformation of rural Europe is not a purely technical project: it is a governance and capacity-building endeavour. The PoliRuralPlus experience across nine regions confirms that AI can amplify local knowledge, facilitate real-time policy support, and accelerate sustainability transitions: but only when properly rooted in territorial reality. The success of this transformation will depend not only on algorithms, but on the people, institutions, and frameworks that teach those systems what matters in place-based development. The future of rural Europe will be shaped by how well digital tools support, *not replace*, local development processes rooted in identity, landscape, cooperation, and knowledge stewardship. AI must be positioned as an amplifier of these values, not an external substitute.

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