



Policy Paper

Accelerating the adoption of digital Decision Support Systems and sustainability indicator tools in European crop farming

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1.Highlights

The Issue: Adoption of digital Decision Support Systems (DSS) and sustainability indicator tools remains limited across European crop farming despite their potential to support environmental, economic, and climate objectives.

The Findings: The use of a digital decision support system, improved in some functionality by the integrated use of sensor data and information, and remote sensing data, can lead to an improved crop management. The sustainability obtained by the application of this tool gains can be highlighted by using a digital tool calculating sustainability indicators.

The Recommendations: The promotion of the use of digital tools in agriculture can lead to an improved use of resources, and reduced impact under the environmental, economic and social aspect.

The Impact: Improved resource efficiency reduced environmental impacts, enhanced farm competitiveness, simplified reporting, and better evidence-based policymaking across the European Union.

2. Context of the Issue

European agriculture is expected to simultaneously improve productivity, reduce greenhouse gas emissions, decrease nutrient and pesticide losses, improve soil health, increase biodiversity, and strengthen climate resilience. Digital technologies have become critical enablers for achieving these objectives.

Decision Support Systems (DSS) assist farmers by integrating weather sensor data, farmers information, and satellite observations to support decisions on irrigation, fertilisation, pest management, yield forecasting. Activities in the Sublab2b targeted the improvement of fertilisation and yield forecasting functionalities, integrating the use of remote sensing data in existing models.

Sustainability indicator platforms translate farm data into measurable indicators such as carbon footprint, nitrogen balance, water-use efficiency, biodiversity performance, soil organic carbon trends, and economic sustainability metrics.

The combined use of decision-support tools and sustainability assessment systems enables more

precise, transparent, and resilient farm management. Integration creates a digital ecosystem where operational decisions can be continuously evaluated against sustainability objectives, transforming sustainability assessment from a reporting exercise into a proactive management tool.

Policy Landscape: The improvement of crop management directly supports the objectives of the European Green Deal, the Farm to Fork Strategy, the Common Agricultural Policy (CAP) 2023-2027, and the Digital Europe Programme, all of which aim to improve sustainability while maintaining agricultural competitiveness and resilience.

The Challenge: Despite the availability of numerous DSS platforms and sustainability assessment tools, adoption remains limited. Major barriers include:

Economic barriers: high investment costs, subscription fees, uncertain return on investment, particularly for small farms.

Technical barriers: poor interoperability, fragmented data standards, connectivity issues, and machinery integration challenges.

Knowledge barriers: insufficient digital skills, lack of advisory support, and difficulties interpreting sustainability indicators.

Governance barriers: uncertainty around data ownership, privacy concerns, and limited trust in data-sharing frameworks.

Project Gap: Current digital solutions often operate independently, creating fragmented workflows and duplicated reporting requirements. The RILab2b provides evidence of improved support to farmers achieved by integrating new relevant input data flow in agricultural forecasting models, thus improving crop management. Moreover, it proves that sustainability indicator systems integrated in a farm decision-support tools enable continuous monitoring of sustainability performance and avoids the need to duplicate data input.

3. Policy Recommendations

- **Integrate Digital Tools into CAP Strategic Plans**

Member States should be encouraged to include Decision Support Systems and sustainability

indicator platforms as eligible investments under CAP interventions. Priority actions include investment grants; eco-scheme incentives; advisory services; innovation partnerships.

Financial support should particularly target small and medium-sized farms, where digital adoption remains comparatively low.

- **Develop EU-wide Interoperability Standards**

Common standards for agricultural data exchange should be strengthened, to ensure compatibility among farm management information systems; sensor networks; satellite services; sustainability assessment platforms.

Open standards reduce vendor lock-in while encouraging innovation and market competition.

- **Promote Trusted Agricultural Data Governance**

The implementation of the European agricultural data space should be promoted, by clarifying data ownership; ensuring farmer control over data sharing; promoting transparent consent mechanisms; encouraging secure cloud infrastructures.

Greater trust will increase willingness to participate in digital ecosystems.

- **Strengthen Agricultural Knowledge and Innovation Systems (AKIS)**

Digital technologies deliver benefits only when accompanied by effective advisory services. Therefore, support should be provided by farmer training; digital extension services; demonstration farms; peer-learning networks; vocational education.

Special attention should be given to digital literacy among small-scale producers.

- **Harmonise Sustainability Indicator Methodologies**

Multiple sustainability assessment tools currently employ different methodologies, limiting comparability. A harmonised framework for calculating farm sustainability indicators should be defined, including greenhouse gas emissions; nutrient balances; water-use efficiency; biodiversity metrics; soil health; resource efficiency; socio-economic indicators.

Standardised methodologies would improve consistency across Member States while reducing reporting burdens.

4. Evidence and Analysis

Key Results: The RILab2b analysis highlights that integrated use of input data deriving from in situ and remote sensing can improve farm management decisions and generate reliable sustainability information for monitoring policy objectives. Benefits include:

- Reduced fertiliser and pesticide losses.
- Lower greenhouse gas emissions.
- Improved water-use efficiency.
- Increased resource efficiency.

Methodology: The analysis is based on the evaluation of digital Decision Support Systems, sustainability indicator tools, and their role in supporting EU agricultural policy objectives. The assessment examines the improvement of decision support for crop management by integrating local and remote sensing data and measuring the sustainability data within crop farming systems.

Limitations: Digital adoption levels vary significantly among regions and farm types. Interoperability challenges, inconsistent methodologies, data governance concerns, and varying digital skills may affect implementation and comparability.

5. Strategic Alignment

The Sustainability performance Lab contributes to broader European objectives under the European Green Deal and the digital transformation of agriculture by improving the availability, quality and usability of model outputs supporting decision-making for crop management.

Policy area	Relevant link	Policy message
European Green Deal	Climate neutrality, biodiversity protection, reduction of environmental impacts in agriculture.	Integrated DSS and sustainability indicator tools support the Green Deal by enabling farmers to monitor and reduce greenhouse gas emissions, optimise input use, improve soil health, and strengthen biodiversity protection through data-driven management.
Farm to Fork Strategy	Sustainable food systems, reduced nutrient losses, reduced pesticide use, and increased resource	Digital decision-support tools help farmers optimise fertiliser, pesticide, and irrigation management while sustainability indicators

Policy area	Relevant link	Policy message
	efficiency.	provide measurable evidence of progress towards Farm to Fork targets.
Common Agricultural Policy (CAP) 2023-2027	Eco-schemes, performance monitoring, farm resilience, innovation, and advisory services.	Adoption of integrated digital tools can strengthen CAP implementation by supporting evidence-based management, reducing reporting burdens, improving monitoring of environmental performance, and enhancing farm competitiveness.
Digital Europe Programme	Digital transformation, data interoperability, digital innovation, and uptake of advanced technologies.	Harmonised digital infrastructures, interoperable platforms, and trusted data-sharing mechanisms facilitate the deployment of sustainability assessment tools and accelerate digital transformation in agriculture.
European Agricultural Data Space	Agricultural data governance, data sharing, interoperability, and farmer control over data.	Clear governance frameworks and trusted data ecosystems are essential to enable secure exchange of farm data between DSS, machinery, sensors, and sustainability assessment platforms.
Agricultural Knowledge and Innovation Systems (AKIS)	Knowledge transfer, advisory services, farmer training, and innovation uptake.	Investments in digital skills, extension services, demonstration farms, and peer-learning networks are critical to ensure effective adoption and use of integrated digital farming solutions.
UN Sustainable Development Goals (SDGs)	SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), SDG 15 (Life on Land).	Integrated digital tools contribute to more sustainable agricultural production by improving resource efficiency, reducing environmental pressures, supporting climate mitigation, and enhancing ecosystem resilience.

6. References

D3.4 ScaleAgData generic architecture and data governance, sharing meta architecture and integration of the RI Labs, v2.

D3.5 Sensor and edge processing selection, development, spatial planning and data collection, v2.

D4.5 Sensor-integrated data products, v2.

D5.2 Deployment and Evaluation Report.

D5.4 Deployment and Evaluation Report, v2 (forthcoming), which contains the second-iteration demonstrator documentation for RIL2a.

D5.5 Replication Guidelines (forthcoming).

D6.5 IPR and Business Model Report (forthcoming).

D6.6 Policy brief (forthcoming).

7. Contact Details

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