QuantiFarm

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Practical Steps Towards Sustainable EU Farming

Aligning DATS use with Local Sustainability Goal

POLICY BRIEF

Highlights

Sustainable agriculture allows future generations to make choices in agriculture that are similar to ours. However, the application of a Digital Agriculture Technology Solutions (DATSs) in a farm can cause environmental, social, and financial sustainability impacts elsewhere (e.g. unemployment or cleaner environment). The political challenge is to align private decisions in farms with society's sustainability objectives without causing market failures.

Evidence from QuantiFarm shows that DATSs most often improve farm viability, resource efficiency, and the combined impact on social, environmental, and financial sustainability (e.g. producers income increases in 58% of cases). However, the impacts are mostly local.

Evidence from QuantiFarm shows also that when farmers have reliable information on profitability and risk, their choices are mostly also sustainable for society. Therefore, if enough information on DATSs is widely available, free competition between DATSs guides towards an economically efficient solution.

We recommend

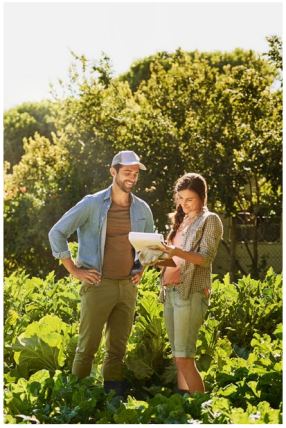
01

Defining sustainability locally for understanding DATS impacts where they act.

02

Closing information gaps on DATS sustainability and profitability.

03



Giving farmers comparison tools for farm-private decision making, and combining DATS evidence to subsidy workflows.

04

Financially supporting targeted socially sustainable DATS that would not otherwise be chosen.

Background & Challenges faced

Technological progress is a primary driver of economic growth. As the adoption of digital technologies expands and continues to stimulate economic development, agriculture is likewise undergoing constant transformation. Neither sustainability in agriculture nor the current status quo can remain static. Achieving sustainable growth requires ongoing technological adaptation to enhance productivity, alongside social adaptation to address the evolving needs of rural communities, among other factors.

Keeping pace with rising living standards, economic growth, and technological progress requires investment in human and intellectual capital in addition to technology. However, since the ability to optimize production, and increase productivity, or profits typically means higher labor productivity, fewer people will produce greater welfare with fewer resources over time. That is obviously a challenge and can lead to declining rural livelihoods.

When selecting DATSs, a farmer does not necessarily value all costs and benefits of its impacts similarly to society. For example, laying off labor and environmental damages have often different private and social values. It is a policy challenge to align farmers' DATS choices with those society prefers

Additional core challenges and possible bottlenecks include:

- Financing and risk-sharing. Capital-intensive DATS may face investment and liquidity constraints, especially for SMEs.
- Market entry barriers for new DATSs. Excessive administrative and regulatory burdens can hinder innovation and prevent new solutions from entering the market.
- Data interoperability and lock-ins. Fragmented interfaces and limited data portability may create switching costs and vendor lock-ins, weakening both private profitability and social returns.
- Information asymmetry. Limited access to reliable performance data can constrain farmers' ability to make informed, like-for-like comparisons, thereby slowing adoption.
- Data governance gaps. While the Data Act strengthens rights for connected product data, gaps persist for manually entered and historical data, perpetuating bargaining imbalances.
- Skills and advisory capacity. The adoption of new technologies requires new skill sets, making workforce reskilling and effective advisory services essential.
- Externalities and labor transitions. While DATSs can improve efficiency and environmental outcomes, they may also disrupt local employment; without reskilling and cooperative models, net social outcomes can become blunted despite productivity gains.

QuantiFarm Insights

Sustainability impacts in this context arise from the changes induced by the application of DATSs. QuantiFarm employed a simple yet innovative methodological approach for estimating sustainability impact from DATS use. Each farm using a DATS in our Test Cases was paired with a comparable farm from the same location – having identical or similar characteristics (size, crop, climatic conditions, etc.) - that did not use a DATS. At the end of each cultivation season, detailed data on agricultural, economic, and sustainability variables were collected and analysed using the project's Assessment Framework to provide tangible evidence of the real-world impact of DATSs, providing clear insights into their effects on both profitability and sustainability outcomes. Private valuation of sustainability impacts counts only monetary costs and benefits that accrue to the farmer who implements the DATS. Instead, their social valuation estimates all social costs and benefits - those that accrue to other members of society, too, such as the costs of unemployment.

Results from the QuantiFarm Test Cases (Figure 1) indicate that producer's income level increases in 58.1% of cases. DATSs mostly improve resource use efficiency (water in 60.5% of cases, nutrients: P 66.7%, N 70%) and reduce labor costs (in 60.6% of cases). However, the effects on workers' income levels are equally affected in both directions. The direct effects on greenhouse gas emissions are also mixed, with emissions decreasing in 46.7% of cases. Since indirect effects, such as those resulting from increased production, have not been taken into account, no conclusions are drawn regarding greenhouse gas emissions.

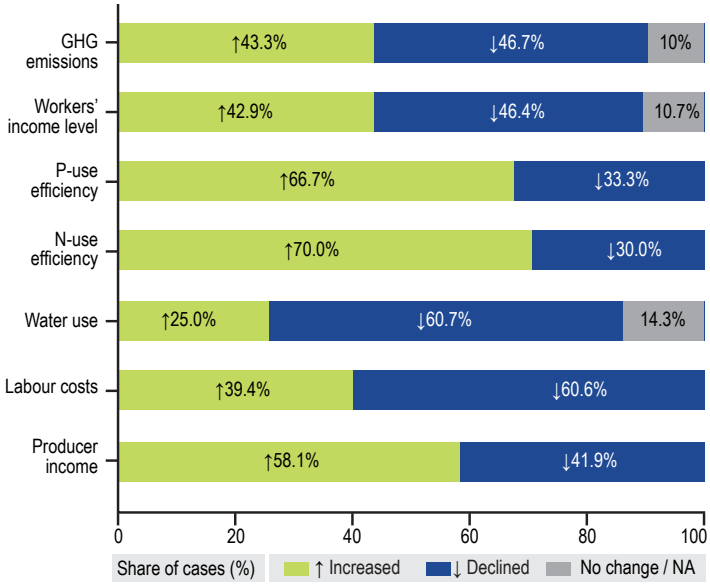


Figure 1 Shares of Test Cases with increase (↑), decline (↓), and no change/NA across a few sustainability measures (100% stacked bars).

Overall, approximately 60 – 70% of the DATS Test Cases can be considered socially sustainable, taking all impacts into account, when their sustainability impacts are assessed with estimations for social costs. These outcomes are highly sensitive to local valuations of social costs, particularly those related to employment.

In DATS implementations, farm-level private profitability shows a strong correlation with social sustainability. Approximately 60% of the Test Cases were both privately profitable and socially sustainable, while around 30% were both privately unprofitable and socially unsustainable. These findings suggest that, had farmers been aware of the profitability outcomes in advance, they would have predominantly selected DATSs that are also socially sustainable.

Policy recommendations

Based on the findings from the sustainability analysis of Test Cases results, we recommend the following policy directions/interventions:

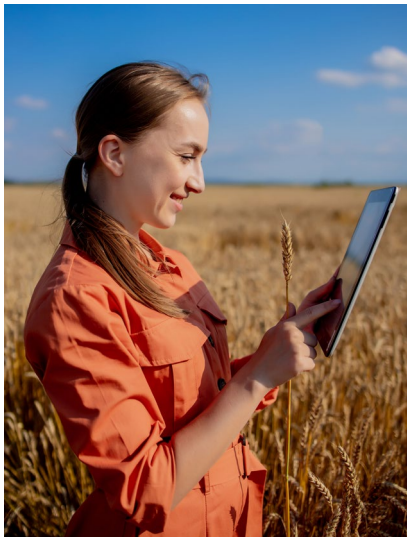
01

Local social sustainability definition policy

Need: Align farm or cooperative-level digital technology choices with locally defined sustainability: social costs and benefits, and priorities.
Action: Local policymakers transparently define sustainability areas, social costs and preferences (e.g., water, nutrients, animal welfare) to guide DATS choices and public support.
Level: Regional/Local authorities in coordination with national CAP Managing Authorities and AKIS.
Primary instruments: CAP Strategic Plans (incl. AKIS as the implementation backbone); alignment with the post-2027 CAP.
Change needed: No new instruments are required: embed local sustainability preferences in Member State Strategic Plans/AKIS guidance, and reference them in calls, advisory mandates and selection criteria.

02

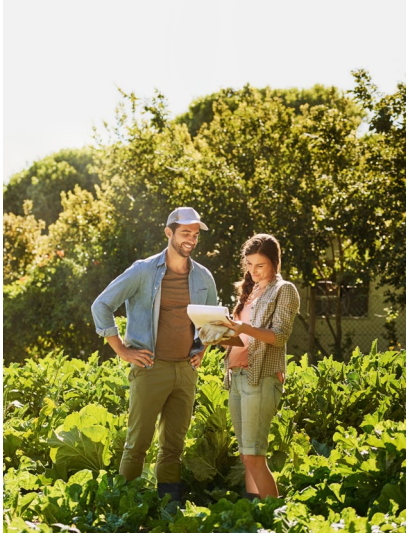
Local information sharing policy



Need: Reduce information asymmetry on DATS performance and match solutions to local sustainability priorities.
Action: Funding information, training and education on the data economy, local sustainability goals and their supporting technologies; provide adequate sustainability information on DATSs and usage methods e.g. via living labs and advisory networks (AKIS).
Level: Regional or Local, with national/EU guidance and AKIS support.
Primary instruments: AKIS in CAP Strategic Plans; ESF+, Erasmus+, Digital Education Action Plan, Pact for Skills and EntreComp for skills/learning; Data Act/Data Governance Act for lawful sharing and intermediation.
Change needed: Financial incentives (programming/prioritisation of calls), improved implementation (AKIS tasking, advisory contracts, living-lab pilots); no new legislation required.

03

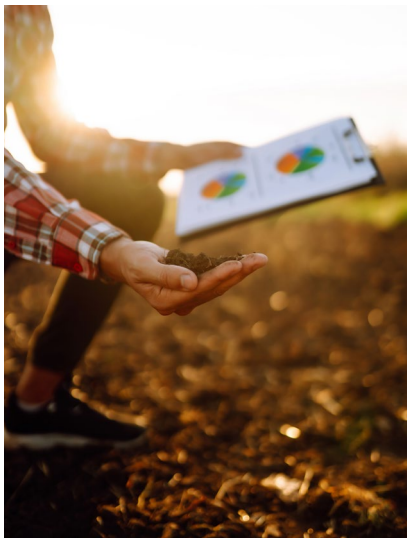
Tools for comparing private benefits & social sustainability



Need: For making informed choices, farmers require transparent, still business sensitive information preserving, tools that allow comparison of the profitability and social sustainability of DATS options, as well as to apply for and receive policy support fairly.
Action: Develop and deploy farm-oriented decision support tools that quantify also sustainability differences between DATS alternatives (e.g., costs, income, water, nutrients, welfare, emissions) and embed them in subsidy or loan workflows.
Level: National/Regional agencies and cooperatives/advisory services; EU provides common guidance/standards.
Primary instruments: FSDN (Farm Sustainability Data Network) to standardize indicators; AKIS and CAP Strategic Plans for advisory uptake; Open data provisions and Data Act portability to feed tools with real-world data.
Change needed: Implementation (tool procurement, advisory integration, interoperability with application portals); regulatory adjustments are not strictly needed if tools use existing lawful bases and indicators; targeted financial support for tool roll-out and farmer onboarding.

04

Policy for targeted support for sustainable impacts in DATS choices



Need: Some socially sustainable DATS are not privately chosen under current market conditions.
Action: Provide targeted support (e.g., subsidies, risk-sharing finance) for evidence-based socially sustainable DATS when they would otherwise not be adopted, using the tools in point 3 to document the case.
Level: National/Regional via CAP instruments and financial tools; EU coherence on metrics/evidence.
Primary instrument(s): CAP Strategic Plans (investment support, eco-schemes/Agri-environment-climate measures); State-aid/GBER compatibility for innovation/environmental measures; EIB/EIF and national promotional banks for guarantees/loans/leasing.
Change needed: Financial incentives (vouchers, lump sums, low-interest loans, guarantees) and improved implementation (eligibility for the service layer: software, maintenance, advisory); no new instrument is required if configured within current CAP/State-aid frames.

Additionally, we recommend maintaining guardrails against market failures in policy design. Policy decisions should minimize market failure risks — notably information asymmetries, lock-ins, and barriers to fair competition—by ensuring open, comparable evidence, interoperable data practices, and competitive neutrality in support schemes, among others.

6 Feasibility & impact potential

The proposed sustainability recommendations can be operationalized through existing instruments by tightening implementation within the CAP and AKIS, aligning (monitoring) indicators with FSDN, and leveraging the Data Act and Data Governance rules to enable the secure and privacy-preserving use of data, among others. Implementation should be locally tailored by design while ensuring EU-wide coherence in data standards and evidence.

Further reading-references

QuantiFarm Deliverable ”D5.4: Policy Recommendations”

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