



30 Test Cases

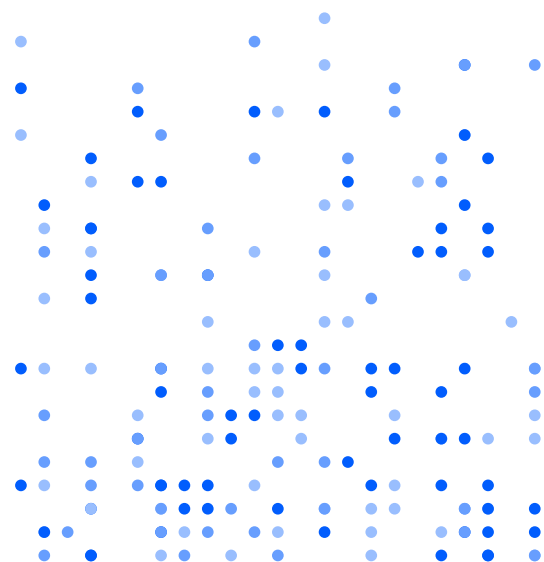
20 Countries

10 Biogeographical Regions

1 Toolkit 1 Digital Innovation Academy

Assessing the Impact of Digital Technology Solutions in Agriculture in Real-Life Conditions

quantifarm.eu



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The EU project QuantiFarm

Across Europe, farmers face increasing pressures, including climate variability, rising input costs, labour shortages, stricter environmental requirements, evolving CAP measures, and the need to remain competitive in global markets. Digital Agriculture Technology Solutions (DATSs) have the potential to address these challenges; however, their adoption remains uneven and often uncertain.

QuantiFarm addresses this gap through a simple yet innovative methodological approach. Each farm implementing a DATS within the Test Cases (TCs) is paired with a comparable farm in the same location, sharing

similar characteristics (e.g. size, crop type, and climatic conditions) but not using a DATS. At the end of each cultivation season, detailed farm-level data—covering agricultural, economic, and environmental variables—are collected from both farms.

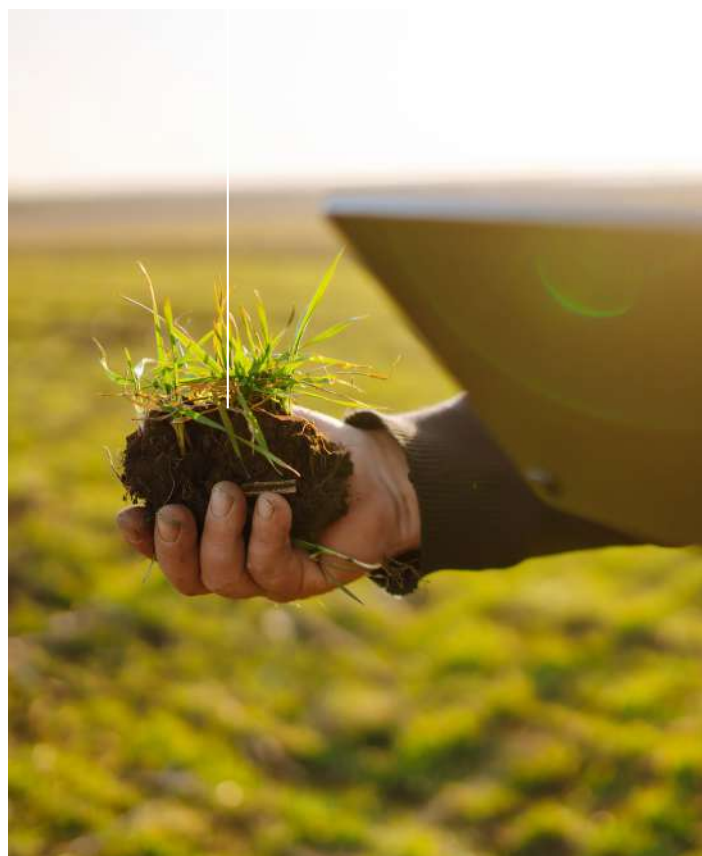
These data are analysed and compared using the project's Assessment Framework to quantify the actual impacts of DATS adoption. This robust and systematic approach generates tangible, evidence-based insights into the real-world performance of digital technologies, clearly demonstrating their contribution to farm profitability and environmental sustainability.

The project set out to support the further deployment of digital technologies in agriculture as key enablers for improving economic, environmental, and social sustainability. It did so by establishing:

A robust Assessment Framework to evaluate the impact and effectiveness of DATSs

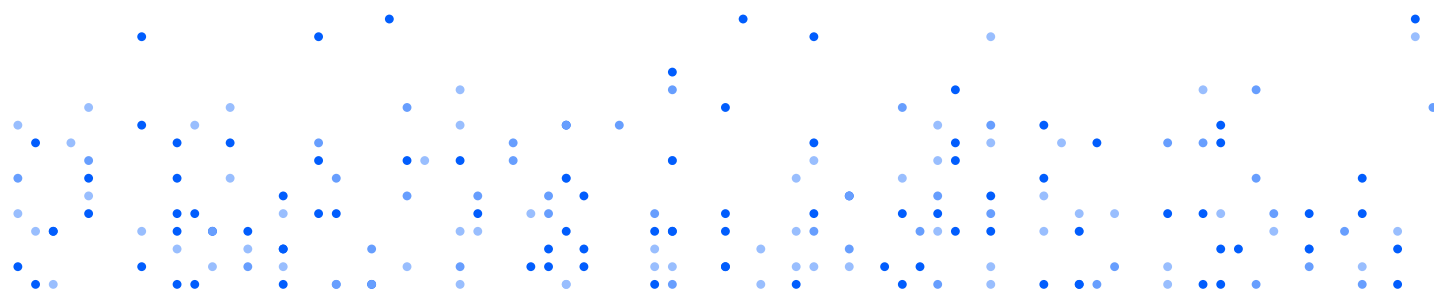
A set of innovative digital tools and services for farmers, advisors, and policymakers

Evidence-based policy recommendations grounded in real-life testing



At its core, QuantiFarm addressed a fundamental question:

Do Digital Agriculture Technology Solutions truly deliver measurable value in real farming conditions, and under which circumstances?

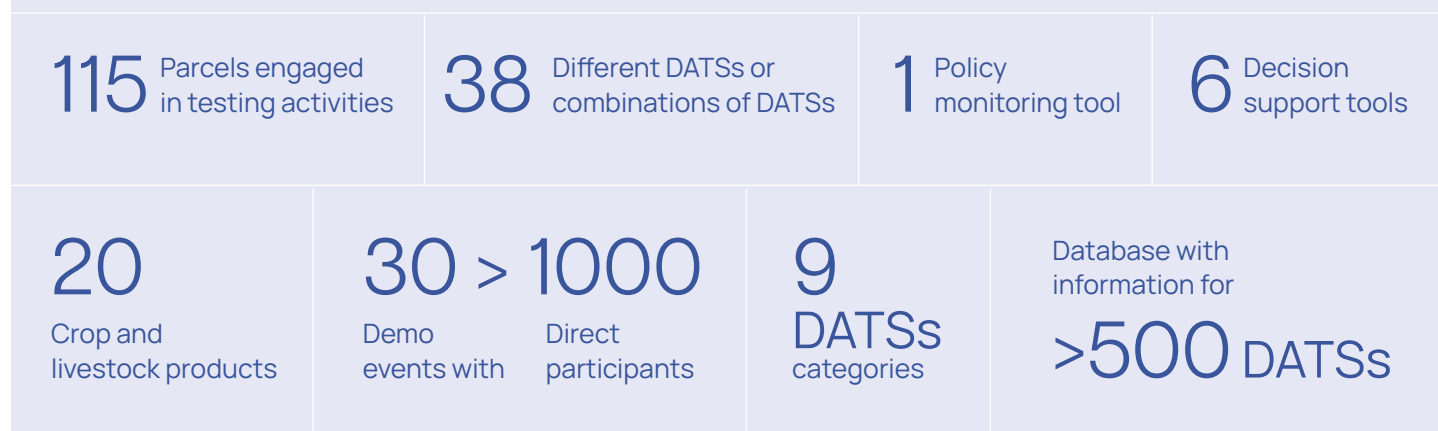


A Truly European, Multi-Actor Effort

QuantiFarm was implemented by a consortium of 32 partners representing research institutions, advisory services, farmers' organisations, technology providers, policy stakeholders, and innovation hubs across Europe.



The project was built around 30 commercial Test Cases (TCs) operating in 20 countries and covering 7 agricultural sectors:



All Test Cases took place in real commercial farms, not experimental plots, ensuring that results reflect authentic production conditions.

Over three full annual production cycles, DATSs were tested, monitored, and evaluated using harmonised methodologies.

This scale and diversity ensured that QuantiFarm's findings are:

Representative across different climate and farm types

Relevant for multiple business models

Grounded in real operational constraints



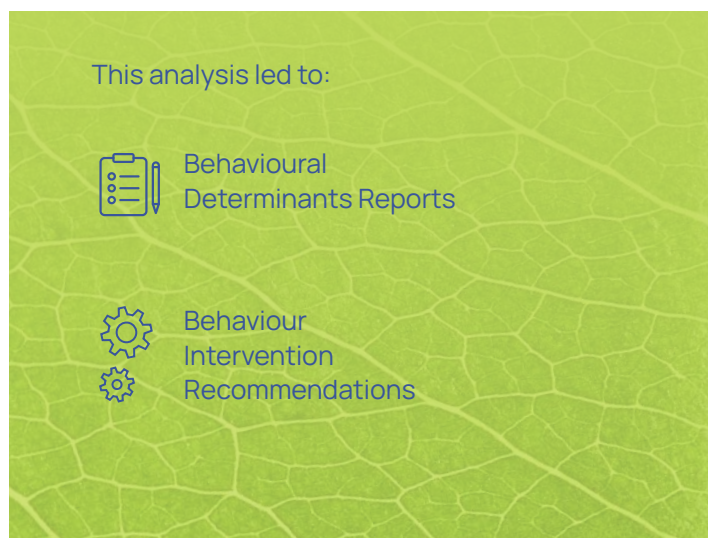
Understanding Adoption: Beyond Technology

One of QuantiFarm's most distinctive contributions was its **behavioural analysis of DATSs adoption**.

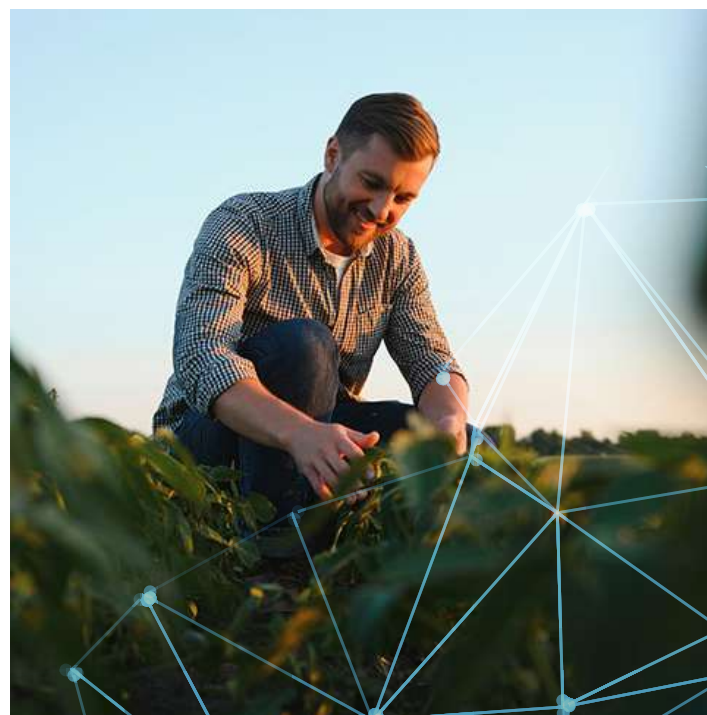
Rather than assuming adoption is a simple yes/no decision, the project investigated:



Through desk research, surveys, immersive observation in selected Test Cases, and stakeholder workshops, the project identified key behavioural drivers and barriers.



This behavioural lens ensured that QuantiFarm moved from a “technology push” approach to a farmer-centred behavioural pull.



The QuantiFarm Assessment Framework

A core achievement of the project was the development of a **comprehensive Assessment Framework** for evaluating DATSs.

What made it unique?

It combined:

- Financial valuation**
(e.g. investment cost, operational savings, ROI)
- Environmental impact assessment**
- Social sustainability indicators**
- Ecosystem services valuation**
- Qualitative evaluation of non-monetary aspects**

Rather than relying on isolated case studies, QuantiFarm created a harmonised, multi-dimensional framework capable of:

Comparing DATSs across sectors

Assessing both individual production steps and whole-farm approaches

Reflecting farm-level and society-wide perspectives

The framework was iteratively updated across three testing rounds, ensuring methodological robustness and validation through real-world evidence.

A governance mechanism was also established to ensure:

Transparency

Impartiality

Third-party verifiability



This marked a major step toward standardised, comparable DATSs assessment at the European level.

A Lasting European Legacy

A validated Assessment Framework	120+ Commercial DATSs reviewed	A fully operational Toolkit on a database of >500 DATSs	38 DATSs examined & assessed in our
A sustainability and exploitation Strategy	A digital Innovation Academy	Policy recommendations	30 TCs using the Assessment Framework

Most importantly, QuantiFarm shifted the European discussion on digital agriculture from promise to proof.



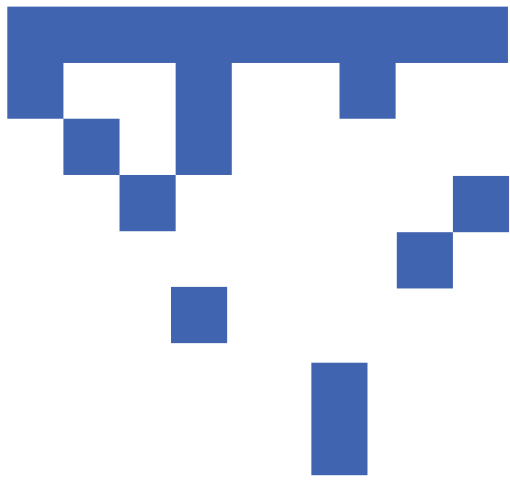
It demonstrated that:

DATSS can deliver measurable value

Context matters

Adoption is behavioural
as much as technical

Evidence must guide
both investment and policy



TOOLKIT



WHAT IS THE QUANTIFARM TOOLKIT

The QuantiFarm Toolkit is an online user-friendly dashboard designed to increase information availability regarding digital agriculture technology solutions (DATSs) and support evidence-based decision making through credible performance assessments. It features 4 Decision Support Tools for Farmers & Farm Advisors and 1 Monitoring Tool for Policy Makers. In total, the toolkit contains structured information on more than 500 DATSs and draws upon data from 30 QuantiFarm Test Cases and relevant external databases. The toolkit enables users to input farm-specific data and receive customized assessments and advisory insights.

KEY OBJECTIVES

Provide reliable, comparable assessments of DATSs

Support decision-making for selecting and investing in DATSs

Enable users to estimate economic, social, and environmental impacts

Strengthen collaboration between farmers, advisors, technology providers, and policymakers

MAIN FEATURES

Recommendation Tool

The QuantiFarm Recommendation Tool helps farmers and advisers identify the most suitable Digital Agriculture Technology Solutions (DATSs) based on their specific farm characteristics, needs, and objectives. By combining data from real-life test cases with user inputs, the tool generates tailored recommendations indicating which technologies offer the highest potential value in terms of performance, cost-effectiveness, and sustainability impact. It supports evidence-based decision-making and reduces uncertainty when selecting new digital tools.

Cost & Benefit Calculators

The Cost & Benefit Calculators help farmers and advisers estimate the financial impact of adopting digital agriculture technologies Solutions (DATSs). Through dedicated modules for crop and livestock systems, users can explore data from both commercial technologies and QuantiFarm test cases. By entering basic information—such as farm size, number of units, years of use, yield, and costs—the tool generates key economic indicators including operational savings, potential revenue gains, Return on Investment (ROI), and Net Benefit. This provides users with a clear, realistic view of the economic feasibility and profitability of DATSs across their lifecycle.

Policy Monitoring Tool

The Policy Monitoring Tool provides policymakers with an interactive dashboard for analysing regional agricultural performance using data from QuantiFarm test cases and multiple European datasets. It visualises anonymised, aggregated information from parcels using and not using DATSs, combined with Earth Observation products and official statistics, to generate summary tables, charts, and regional comparisons. Through indicators grouped into thematic categories, the tool supports three core functions: tracking generalised sustainability indicators, assessing DATSs vs. non-DATSs performance, and benchmarking regions against established thresholds. This enables evidence-based policy evaluation and more informed decision-making at regional level.

Real Assessment Results

QuantiFarm evaluates the performance of Digital Agriculture Technology Solutions (DATSs) across 30 real-life Test Cases. More details on the assessment methodology are available [here](#). The evaluation results refer strictly to the specific context in which each assessment was conducted (e.g., parcel, year, crop type, and local conditions).



WHO IS IT FOR?



Farmers & Farmers' Organisations
for practical decisions on whether to adopt a DATSs



Researchers
to access harmonised evaluation methodologies



Advisors & Advisory Services
for structured advisory support



Technology Providers
to showcase validated performance



Policymakers & Paying Agencies
to design evidence-based support measures

BENEFITS

Helps farmers reduce uncertainty when investing in digital
What tools

Improves transparency and comparability across DATSs

Supports sustainable agriculture with measurable indicators

Strengthens the European digital agriculture ecosystem

Facilitates policy alignment with Green Deal, Farm-to-Fork,
and CAP objectives

WHAT IS IT?

The **QuantiFarm** Recommendation Tool is an interactive, web-based component of the QuantiFarm Toolkit designed to help users identify the most suitable Digital Agriculture Technology Solutions (DATSs) for their needs. Drawing on performance data from 40 DATSs evaluated across the QuantiFarm Test Cases, as well as an inventory of more than 500 digital solutions, the tool provides personalized recommendations based on farm profile characteristics, production systems, operational criteria and sustainability preferences. The tool allows users to explore available DATSs, refine their search through multiple filters, and receive tailored recommendations aligned with their farm characteristics and user-defined preferences, ultimately generating a shortlist of solutions that can effectively support farmers in their operations.

WHO IS IT FOR?



Farmers seeking practical guidance on which DATSs best match their farm type, conditions and objectives



Advisors & Advisory Services supporting digitalisation decisions



Agricultural consultants, cooperatives and producer groups looking for comparable insights on multiple DAT options



Policymakers & Stakeholders interested in understanding the suitability and applicability of DATSs across sectors and regions

KEY OBJECTIVES

To **support evidence-based selection** of Digital Agriculture Technology Solutions

To enable **personalised recommendations** based on farm profiles, needs, and technological capabilities

To increase **transparency** by presenting DATSs' functionalities, benefits, digital formats, language availability, and cost structures

To provide **easy access to real-world performance data** collected from QuantiFarm Test Cases

To enhance the **uptake of digital technologies** by simplifying search, comparison, and evaluation of DATSs

MAIN FEATURES

Natural Language Search

Users can enter free-text queries to quickly identify DATSs relevant to their needs

Recommendation Algorithms

Users can select a preferred algorithm to produce tailored lists of DATSs that best match their requirements.

Advanced Filtering Options

DATSs can be filtered by multiple parameters including:

- Agricultural sector
- Functionality (e.g., monitoring, decision support, automation)
- Expected benefits
- Digital form (hardware, software, services)
- Language and country availability
- Cost structure
- Farmer profile
- Sustainability preferences

Detailed DATS Information

Upon selecting a recommended DAT, users can view:

- Key parameters
- Functionalities and benefits
- Cost structure
- If available, linkages to **QuantiFarm Test Cases** where the DAT has been assessed in real farming conditions

Farm & Farmer Profile Matching

Recommendations can be generated based on user-defined farm characteristics, including:

- Farm type (arable, dairy, fruit, etc.)
- Country and preferred language
- Types of technologies the farmer can work with
- Desired functionality and benefits

User-Friendly Interface

A clear dashboard layout supports easy navigation, comparison, and exploration of DATSs

WHAT IS IT?

The **Cost & Benefit Calculators** tool is an interactive component of the QuantiFarm Toolkit that supports the economic assessment of Digital Agriculture Technology Solutions (DATSs).

It enables users to estimate the financial implications of adopting DATSs in both crop and livestock farming systems, using farm-specific inputs and harmonised calculation modules. By translating technical impacts into economic indicators such as investment costs, operational savings, Return on Investment (ROI), and Net Benefit, the tool provides a clear and realistic view of the economic feasibility of digital technologies across their lifecycle.

KEY OBJECTIVES

To **support evidence-based decision-making** on the adoption of Digital Agriculture Technology Solutions

To **estimate and compare the economic costs and benefits** of DATSs in crop and livestock farming systems

To **translate farm-level data into comparable economic indicators**, including ROI and Net Benefit

To **reduce uncertainty and investment risk** associated with digital technology uptake

To **contribute to a better understanding of the economic performance of DATSs** across diverse farming contexts

MAIN FEATURES

Structured DATS search & selection

Users can filter DATSs by farming system, crop or live-stock type, DATS category, and farming practice.

Automated system analysis

Results are calculated dynamically based on user inputs and farming system-specific formulas.

DATS evaluation with descriptive information

Users can filter DATSs by Each DATS includes details such as purpose, provider, platform, and cost information to support informed selection.

Clear presentation of results

Outputs include consolidated results with ROI, net benefit, total costs, and total savings, displayed in an intuitive dashboard.

Farm-specific data input

Users enter their own operational data (e.g., area, yields, input costs, animal numbers, production levels). Users can filter DATSs by Each DATS includes details such as purpose, provider, platform, and cost information to support informed selection.

Applicability to both crop & livestock systems

Tailored calculator modules reflect the specific economics of different farming contexts.

Modular calculation engine

Dedicated calculator modules estimate:

- Investment and operational costs
- Yield or productivity increases
- Input reductions (e.g., fertiliser, water, feed, labour, energy)
- Revenue increases and cost savings

WHO IS IT FOR?



Farmers and Farm Managers seeking to evaluate whether a DATS is economically viable for their farm



Advisers, consultants and advisory services supporting investment and digitalisation decisions



Digital Innovation Hubs and technology promoters demonstrating the economic value of DATSs



Policymakers & other Stakeholders interested in understanding farm-level economic impacts & the scalability of digital solutions

WHAT IS IT?

The Policy Monitoring Tool is an interactive, web-based of the QuantiFarm Toolkit designed to support the assessment of agricultural performance at the regional level in relation to CAP targets. It facilitates evidence-based policy implementation and monitoring by integrating anonymised and aggregated in-situ data from selected QuantiFarm Test Cases to calculate performance metrics at the regional level (e.g. Local Administrative Unit – LAU/commune level), using extrapolation and crop classification methods.

The tool provides a visual policy monitoring dashboard that enables users to generate analytical reports, summary tables, and graphical charts based on user-defined queries. Its functionalities are structured around three main pillars:

- **Generalised Indicators Tracking:** Collection and aggregation of in situ data focusing on variables such as agrochemicals use, irrigation practices, costs and other indicators to assess the environmental, social or economic impact of regional agricultural activities.
- **DATS vs. Non-DATS Parcel Performance:** Analytical calculations that evaluate the effectiveness of Digital Agriculture Technology Solutions (DATSs) compared with traditional farming methods that do not use digital technologies.
- **Regional Benchmarking:** Involves integrating established regional benchmark values/thresholds derived from multiple heterogeneous sources, enabling a contextual understanding of a region's relative performance.

KEY OBJECTIVES

To **support evidence-based policy monitoring and evaluation** in agriculture

To **analyse regional agricultural performance** using harmonised indicators

To **compare parcels using Digital Agriculture Technology Solutions (DATSs) with non-DATSs parcels**

To **assess the environmental, economic, and social impacts** of agricultural practices at the regional scale

To **provide benchmarking against regional thresholds & reference values**

To **strengthen transparency and comparability** of digitalisation impacts across regions

MAIN FEATURES

Interactive policy monitoring dashboard

Visualises regional data through maps, charts, and summary tables.

Structured indicator framework

Provides access to 50 aggregated indicators organised into 13 thematic categories (e.g., fertilisers, water, energy, productivity, social indicators).

Multi-source data integration

Combines QuantiFarm Test Case data with Earth Observation products, European GIS datasets, and policy-relevant statistics (e.g., Eurostat, FADN).

DATS vs. non-DATS comparison

Enables direct comparison of regional performance between parcels using DATSs and those using conventional practices.

Regional benchmarking

Contextualises results against established benchmarks and thresholds to assess regional 'standing.'

Customisation and export

Allows users to customise graphs and export data and visualisations in reusable formats (CSV, PNG, PDF, SVG).

Together, these features support robust, transparent, and scalable policy analysis on the impacts of digital agriculture.

WHO IS IT FOR?



Researchers and analysts
working on agricultural performance and sustainability



Advisors and other stakeholders
interested in regional evidence on digital agriculture impacts



Managing authorities supporting agricultural programmes



Policymakers & other Stakeholders interested in understanding farm-level economic impacts and the scalability of digital solutions



Policymakers and public authorities at the local, regional, and national levels

It supports users seeking **aggregated, comparable, and evidence-based insights** to inform policy design, monitoring, and evaluation.

WHAT IS IT?

The Benchmarking Tool is an interactive, web-based component of the QuantiFarm Toolkit that supports the comparison of agricultural performance across parcels, time periods, and farming practices. It enables users to cross-reference farm management events, meteorological measurements, pesticide active ingredients and fertilizer applications, and calculated indicators to analyse differences between different parcels or the same parcel over time. By combining user-provided parcel data with recorded cultivation practices and environmental measurements, the tool generates performance indicators that allow users to benchmark resource use and assess management outcomes under real farming conditions.

WHO IS IT FOR?



Farmers and Farm Managers seeking to compare performance between parcels or seasons



Advisers and advisory services supporting evidence-based farm management decisions



Researchers and Analysts analysing cultivation practices and performance indicators



Technology and Innovation stakeholders interested in understanding DATS-related impacts at the parcel level

The tool supports users who wish to explore **data-driven comparisons** of agricultural practices and outcomes.

KEY OBJECTIVES

To enable benchmarking of farm performance indicators across parcels and time periods

To support the comparison of management practices, including irrigation, fertilisation, spraying, and harvesting

To link cultivation practices with environmental and meteorological data

To support evidence-based evaluation of Digital Agriculture Technology Solutions (DATSs)

To enhance understanding of resource use and management efficiency under different farming conditions

MAIN FEATURES

Parcel-level data management

Users can create and manage parcels individually or through CSV import, including spatial boundaries.

Indicator calculation and benchmarking

Automatically generates aggregated indicators (e.g., totals, averages, minimums, maximums) and specialised calculations (e.g., chilling days).

Farm calendar event recording

Supports structured recording of key operations such as **sprays, irrigations, fertilisations, and harvests**.

Cross-parcel and temporal comparison

Allows direct comparison between **different parcels or different periods of the same parcel**.

Meteorological data integration

Enables the inclusion of measurements such as **temperature, humidity, wind, rainfall, and leaf wetness**.

Links to DATSs' resources and Test Cases

Results can be connected to relevant **DATSs information and QuantiFarm Test Cases**, providing contextual insights.

Pesticide use analysis

Identifies the top five pesticide active ingredients used, improving transparency in input management and enabling targeted reduction strategies.

Expanded fertiliser analysis

Provides detailed N-P-K quantification, enabling precise assessment of nutrient use and more efficient, sustainable fertilisation practices.

Together, these features **support systematic benchmarking and comparative analysis** of agricultural performance at parcel-level.

WHAT IS IT?

The **Advanced Decision Support Tool** is a structured decision-making component of the **Quanti Farm Toolkit** that supports the **selection of the most appropriate Digital Agriculture Technology Solutions (DATSs)** for a specific farm.

It applies a **multi-criteria assessment framework** that combines **Strategic Fit analysis, Quality Function Deployment (QFD), and the Analytic Hierarchy Process (AHP)** to evaluate DATSs against farm-specific goals, stakeholder needs, and contextual factors.

By systematically translating **qualitative preferences and strategic considerations** into **comparable decision scores**, the tool helps reduce uncertainty and supports **evidence-informed technology adoption decisions**.

WHO IS IT FOR?

The Advanced Decision Support Tool is designed for:



Farm Advisers and Consultants supporting farmers in digitalisation decisions.



Farmers and Farm Managers involved in structured technology selection processes.



Digital Innovation Hubs and Technology Facilitators assisting farms in the adoption of DATSs.



Researchers and Innovation Stakeholders analysing technology uptake drivers.

The tool is particularly suited to **advisor-led decision-making processes** that require a systematic and transparent evaluation approach.

KEY OBJECTIVES

To support the selection of DATSs that best fit farm-specific strategic goals and preferences

To integrate farmers', customers', and partners' needs into the decision-making process

To address uncertainty around the benefits, costs, and risks of digital technologies

To enable transparent and reproducible multi-criteria evaluation of DATSs

To reduce barriers to digital technology adoption through structured, evidence-based assessment

MAIN FEATURES

Multi-step decision framework

Guides users through a three-step process: **Strategic Fit filtering, QFD-based stakeholder needs assessment, and final ranking using AHP.**

Multi-criteria evaluation and weighting

Applies structured weighting and pairwise comparisons across **technological, organisational, environmental, benefit, and cost criteria.**

Farm strategy alignment

Evaluates DATSs against predefined **farm strategic goals** (e.g., cost reduction, sustainability, risk reduction, innovation).

Transparent scoring and ranking of DATSs

Produces **comparable scores and rankings** that clearly indicate the most suitable DATS for a specific farm context.

Stakeholder needs integration

Incorporates the needs of **customers and partners** (e.g., quality, traceability, consistency, sustainability) into the evaluation.

Offline usability

Currently available as a **downloadable spreadsheet-based tool**, enabling offline

Together, these features **support systematic benchmarking and comparative analysis** of agricultural performance at parcel-level.

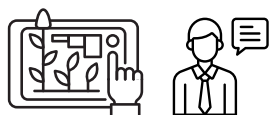
WHAT IS THE DATS ASSESSMENT ENGINE?

The “DATS Assessment Engine” constitutes the GUI-based implementation of the Assessment Framework and operates as a standalone DSS service within the QuantiFarm Toolkit. The tool builds on the framework’s architecture and its comparative analytical approach (DATS use vs non-DATS use) incorporating standardized web-based data collection forms and automated calculation algorithms to generate DATSs assessment results. It processes raw farm-level data into quantitative performance indicators, providing intuitive visualizations of cost-revenue and sustainability impacts. It can be downloaded and executed locally on a personal computer and provides a graphical user interface to facilitate data import and result visualization.

WHO IS IT FOR?



Farm advisors to conduct structured and reliable DATS performance assessments



Technology Providers to demonstrate and validate the performance of their solutions based on real use cases

KEY OBJECTIVES

To obtain reliable assessments of the economic and sustainability performance of a digital solution at farm level.

To translate farm data into cost-revenue indicators, including ROI and Net Benefit.

To support the comparison of management practices across parcels based on DATS use and non-DATS use.

MAIN FEATURES

Composite monetary index complemented by descriptive indicators

81 performance indicators covering economic and sustainability dimensions

Analysis of individual production steps and full farm systems

Suitable for both crop & livestock systems

Built-in algorithms for automated assessment

30 crop specific formulas to choose from

Visual outputs for easy interpretation of findings

Downloadable results and analytics for further use

THE DIGITAL INNOVATION ACADEMY

WHAT IS IT?

The QuantiFarm Digital Innovation Academy (DIA) is a comprehensive capacity building program designed to strengthen the capacities of farm advisors and rural consultants in the field of digital farming. The mission of the Academy is to empower advisors with the knowledge and (technical and soft) skills required to deliver innovative, personalised advisory services related to the selection, uptake and effective application of DATSs, based on the unique needs and specific characteristics of individual farms.

Grounded in real-world insights from QuantiFarm R&I activities and integrating technical, behavioural, and didactical competences within a scalable hybrid framework, the DIA effectively responds to the prevailing mismatch between advisors' existing capabilities and the evolving demands of digital agriculture, also addressing the gaps in existing training provision at both higher and vocational levels.

WHO IS IT FOR?



Farm Advisors and Rural Consultants seeking to deepen their knowledge of digital farming, and become acquainted with farm oriented-communication and advisory strategies.



Agricultural Educators and Training Providers seeking to align their offerings and courses with emerging training requirements related to digital agriculture.



Agricultural Students and early-career Advisors looking to build expertise in data-driven farming practices, stay up-to-date with digital developments and strengthen their employability.



Stakeholders supporting the digital transition who need to understand how to effectively advise, benchmark, and support farmers using DATSs.

PEDAGOGICAL AND CONTENT

The DIA follows a hybrid Train-the-Trainer and Direct End-User Training scheme, providing knowledge and skills development across five thematic areas:

1. The evolving role of farm advisors in supporting digital uptake.
2. Behavioural determinants affecting DATSs adoption and strategies for effective communication with farmers.
3. Digital Agricultural Technology Solutions (DATSs): Categories, application scope, technical specs, costs, benefits, and sustainability gains.
4. Key factors affecting the effective integration and optimal performance of a digital solution on the farm, including business and operational interventions that maximise the effectiveness of DATSs in practice.
5. How to use the QuantiFarm Toolkit for supporting farmers in making informed decisions on DATSs selection based on their needs.

MAIN FEATURES

Programme specifications

- 7 modules
- 41 learning outcomes
- EQF level 5
- Versatile educational resources (annotated presentation slides, video lectures, case studies, blueprints, hands-on exercises, use case studies, handbooks)
- Formative self-assessment (multiple-choice questionnaire & reflection questions)
- Certificate of attendance (workshop participants)

Two tailored learning paths

- Train-the-Trainer: for educators & training professionals to scale advisory services.
- End-User Advisor Training: for farm advisors and rural consultants to gain direct skills in digital farming and digital tool usage.

Four complementary mechanisms

for upskilling farm advisors in the field of digital farming and DATSs, including: a) EU-wide training workshops (TTTs), b) national training sessions with a sectoral, crop/animal-specific focus, c) a digital education platform enabling asynchronous, self-paced learning, and d) integration into formal education, targeting future advisors.

Digital Agriculture Technology Solutions Overview

- 5 DATS categories for crop farming
- 4 DATS categories for livestock farming
- A comprehensive compendium with QuantiFarm DATSs
- Information on more than 500 DATS through the QuantiFarm Toolkit

Modular online educational platform

A self-paced, asynchronous educational environment that allow users to engage with the training content according to their own schedules and learning needs. The platform follows a modular structure and provides open access to all educational resources.

Practical resources

Hands-on training on how to use the QuantiFarm Toolkit, including the Recommendation System and the Cost-Benefit Calculators, to support farmers in selecting the most suitable digital solutions based on their specific needs and contexts.



MAPPING THE DIGITAL AGRICULTURE TECHNOLOGY SOLUTIONS (DATSs)

WHAT ARE DATSs?

Digital Agricultural Technology Solutions (DATSs) are digital tools, systems, and platforms that collect, analyse, and use data to improve farm management, productivity, sustainability, and animal welfare. They support better decisions by turning real-time information into targeted actions.

WHAT ARE CROP FARMING DATSs?

Crop Farming DATSs are digital tools, systems, and platforms that collect, analyse, and use data to support **crop management decisions**.

They help farmers understand what is happening in their fields by transforming **real-time and historical data** into actionable insights related to soil conditions, crop status, weather, and field variability.

By supporting more targeted and timely interventions, Crop Farming DATSs contribute to **improved productivity, sustainability, and farm performance**.

WHO ARE THEY FOR?

Crop Farming DATSs are designed for:



Crop Farmers and Farm Managers seeking to optimise field operations



Advisers and Extension Services supporting data-driven crop management



Agricultural Consultants and Digital Innovation Hubs (DIHs) promoting digital solutions



Researchers and Stakeholders analysing digitalisation in crop farming systems

They are applicable across a wide range of crop types and farming contexts.

KEY OBJECTIVES

To support better farm management decisions through data-driven insights

To increase crop productivity and efficiency

To reduce input use, costs, and operational risks

To improve environmental sustainability and soil health

To enable evidence-based and targeted crop management practices

MAIN FEATURES

Crop Farming DATSs include **Recording & Mapping Technologies (RMT)**, which focus on observing and mapping field conditions:

Soil sensors

Devices placed in the ground that provide information on soil conditions.

Yield mapping tools

Identify spatial variability in crop yields across fields.

Satellite and UAV imagery

Use satellite and drone images to monitor crop status and detect areas of concern.

Weather stations

Monitor rainfall, temperature, wind, and other weather parameters at the farm level.

Together, these technologies help farmers **monitor crop and environmental conditions**, supporting more precise decisions on irrigation, fertilisation, and crop care.



WHAT ARE DATSs?

Digital Agricultural Technology Solutions (DATSs) are digital tools, systems, and platforms that collect, analyse, and use data to improve **farm management, productivity, sustainability, and animal welfare**.

They support better decision-making by transforming **real-time and historical data into targeted, actionable insights** for farmers and advisors.

WHAT ARE CROPS & LIVESTOCK FARMING DATSs?

Crop & Livestock Farming DATSs are digital solutions that support both **crop production and animal production systems**.

They help farmers monitor fields, crops, animals, and environmental conditions, enabling **more precise, timely, and informed management decisions** across the whole farm.

By integrating data from different sources, such as sensors, machinery, weather information, and digital records, these DATSs support **efficient resource use, improved productivity, and sustainable farm practices** in mixed or specialised farming systems.

WHO IS IT FOR?

Crop & Livestock Farming DATSs are designed for:



Farmers and Farm Managers operating crop, livestock, or mixed farming systems



Advisers and Extension Services supporting data-driven farm management



Agricultural Consultants and Digital Innovation Hubs (DIHs) promoting digital solutions



Researchers and Stakeholders analysing digitalisation in crop and livestock farming

They are applicable across different farm sizes, production systems, and geographic contexts.

KEY OBJECTIVES

To support better farm management decisions through data-driven insights

To increase productivity and efficiency in crop and livestock systems

To reduce input use, costs, and operational risks

To improve environmental sustainability, soil health and animal welfare

To enable evidence-based and targeted crop management practices

MAIN FEATURES

Crop & Livestock Farming DATSs include a range of digital technologies that support observation, guidance, and management across the farm:

Recording & Mapping Technologies (RMT)

Purpose: Observe and map what is happening in fields and on the farm.

Guidance / Controlled Traffic Farming (CTF)

Purpose: Guide machinery precisely and protect soil.

Soil sensors

Devices placed in the ground that provide information on soil conditions.

GPS auto-steering

Helps tractors drive accurately, saving time and fuel.

Yield mapping tools

Show which parts of a field produce more or less yield.

RTK guidance

Provides high-precision positioning for farm machinery.

Satellite and UAV imagery

Use satellite and drone images to detect crop stress and areas of concern.

Traffic lane planning system

Define optimal machinery paths to reduce soil compaction.

Weather stations

Monitor rainfall, temperature, wind, and other weather parameters at the farm level.

Together, these technologies help farmers **monitor conditions, manage operations more precisely, and optimise both crop and livestock production**, supporting sustainable and efficient whole-farm management.

WHAT ARE DATSs?

Digital Agricultural Technology Solutions (DATSs) are digital tools, systems, and platforms that collect, analyse, and use data to improve farm management, productivity, sustainability, and animal welfare.

They support better decision-making by transforming real-time and historical data into targeted actions on the farm.

WHAT ARE VARIABLE RATE & TECHNOLOGIES (VRT)?

Variable Rate Technologies (VRT) are a category of Crop Farming DATSs that enable the automatic adjustment of inputs, such as fertilisers, pesticides, or water, according to the specific needs of different areas within a field.

Their purpose is to apply the right input, at **the right place**, in **the right amount**, based on field variability and crop requirements.

By adapting application rates in real time or through prescription maps, VRT supports **more precise, efficient, and sustainable crop management**.

WHO ARE THEY FOR?

Variable Rate Technologies are designed for:



Crop Farmers and Farm Managers aiming to optimise input use



Advisers and Extension Services supporting precision crop management



Agricultural Consultants and Digital Innovation Hubs (DIHs) promoting digital farming solutions



Researchers and Stakeholders analysing precision agriculture practices

They are applicable across different crop types and field conditions.

KEY OBJECTIVES

To optimise the use of fertilisers, pesticides, and water

To increase crop productivity and efficiency

To reduce input waste, costs, and operational risks

To improve environmental sustainability by limiting over-application

To support evidence-based and site-specific crop management decisions

MAIN FEATURES

Variable Rate Technologies (VRT) focus on adjusting applications automatically based on field needs:

Variable rate spreaders

Apply different amounts of seeds or fertiliser across the field, ensuring resources are used efficiently, and crops receive what they need.

Variable rate sprayers

Adjust pesticide application rates to match local crop conditions, helping maintain crop health while reducing unnecessary use.

Precision irrigation systems

Deliver the right amount of water exactly where crops need it, saving water and supporting optimal plant growth.

Together, these technologies help farmers **reduce waste, protect the environment, and improve crop performance** through **precise and targeted input application**.



WHAT ARE DATSs?

Digital Agricultural Technology Solutions (DATSs) are digital tools, systems, and platforms that collect, analyse, and use data to improve farm management, productivity, sustainability, and animal welfare.

They support better decision-making by turning real-time information into targeted actions on the farm.

WHAT ARE ROBOTIC SYSTEMS & SMART MACHINES (RSSM)?

Robotic Systems & Smart Machines (RSSM) are a category of Crop Farming DATSs that automate and optimise farm operations by acting directly in the field.

They use automation, sensors, and artificial intelligence (AI) to perform tasks such as planting, spraying, weeding, or harvesting with minimal human intervention.

Their purpose is to carry out farm work autonomously, reducing labour-requirements and improving precision and efficiency in crop production.

WHO IS IT FOR?

Robotic Systems & Smart Machines are designed for:



Crop Farmers and Farm Managers seeking to automate field operations



Advisers and Extension Services supporting advanced digital farming practices



Agricultural Consultants and Digital Innovation Hubs (DIHs) promoting automation technologies



Researchers and Stakeholders analysing robotics and AI in agriculture

They are applicable to **different crop types and farming systems**, especially where labour availability and efficiency are key concerns

KEY OBJECTIVES

To automate repetitive and labour-intensive farm operations

To increase productivity and operational efficiency

To reduce labour costs and operational risks

To improve precision in field operations

To support sustainable and innovative crop farming practices

MAIN FEATURES

Robotic Systems & Smart Machines (RSSM)
focus on automated field operations:

Field robots

Robots that replace or support human labour in tasks such as harvesting, weeding, and other farm practices.

Drones, autonomous tractors, and smart autonomous sprayers

Machines that operate independently, performing field work with high precision and reducing reliance on traditional tractors.

Together, these technologies help farmers **save time and effort**, **improve precision**, and **optimise crop management** through automation.

WHAT ARE DATSs?

Digital Agricultural Technology Solutions (DATSs) are digital tools, systems, and platforms that collect, analyse, and use data to improve farm management, productivity, sustainability, and animal welfare.

They support better decision-making by turning real-time information into targeted actions on the farm.

WHAT ARE FARM MANAGEMENT INFORMATION SYSTEMS (FMIS) & DECISION SUPPORT SYSTEMS (DSS)?

Farm Management Information Systems (FMIS) and Decision Support Systems (DSS) are a category of Crop Farming DATSs that combine farm data into a single decision platform.

They help farmers organise, store, and analyse information related to crop production, costs, inputs, and farm activities, supporting both day-to-day and strategic decisions.

Their purpose is to bring all relevant farm information together and transform it into useful recommendations and insights for better crop management.

WHO IS IT FOR?

FMIS and DSS are designed for:



Crop Farmers and Farm Managers seeking structured and data-driven decision support



Advisers and Extension Services supporting farm planning and management



Agricultural Consultants and Digital Innovation Hubs (DIHs) promoting integrated digital tools



Researchers and Stakeholders analysing digital farm management practices

They are suitable for different crop types, farm sizes, and production systems.

KEY OBJECTIVES

To support informed and timely farm management decisions

To improve productivity and operational efficiency

To reduce costs and operational risks

To support environmental sustainability and resource-efficient farming

To enable evidence-based crop management and planning

MAIN FEATURES

Farm Management Information Systems (FMIS) and Decision Support Systems (DSS)
focus on integrating and analysing farm data:

Digital farm management platforms

Web-based platforms or smartphone applications that organise and manage farm information in one place.

Digital farm logs and record-keeping

Tools that record field operations, inputs, and activities, supporting planning, monitoring, and compliance.

Decision support and cost-benefit tools

Applications that analyse farm data and provide recommendations or economic insights to support decisions

Traceability systems

Digital systems that document production processes and inputs, supporting transparency and traceability.

Together, these tools help farmers keep track of data, plan activities more efficiently, and make better-informed decisions, supporting sustainable and resilient crop farming.

WHAT ARE DATSSs?

Digital Agricultural Technology Solutions (DATSSs) are digital tools, systems, and platforms that collect, analyse, and use data to improve farm management, productivity, sustainability, and animal welfare.

They support better decision-making by turning real-time information into targeted actions on the farm.

WHAT ARE AUTOMATIC MILKING SYSTEMS (AMS)?

Automatic Milking Systems (AMS) are a category of Livestock Farming DATS that automate the milking process while improving efficiency and animal comfort.

They allow cows to be milked automatically and regularly, without continuous human intervention, using specialised equipment that adapts to each animal.

Their purpose is to save time, improve milking consistency, and enhance animal welfare, while supporting efficient dairy farm operations.

WHO IS IT FOR?

Automatic Milking Systems are designed for:



Dairy Farmers and Farm Managers seeking to automate milking operations



Advisers and Extension Services supporting modern dairy farm management



Agricultural Consultants and Digital Innovation Hubs (DIHs) promoting livestock digitalisation



Researchers and Stakeholders analysing automation in dairy farming

They are applicable to different dairy farm sizes and production systems.

KEY OBJECTIVES

To automate the milking process

To increase productivity and operational efficiency

To reduce labour requirements and operational risks

To improve animal comfort and welfare

To support consistent and data-driven dairy management

MAIN FEATURES

Automatic Milking Systems (AMS) focus on automated and efficient milking operations:

Robotic milking systems

Robots milk cows automatically without human presence, saving time and supporting cow health through gentle and regular milking.

Automated milking parlours

Systems that milk multiple cows simultaneously using specialised automated equipment.

Together, these technologies help dairy farmers **optimise labour use, improve animal welfare, and increase productivity**, supporting **sustainable and modern livestock farming**.



WHAT ARE DATSSs?

Digital Agricultural Technology Solutions (DATSSs) are digital tools, systems, and platforms that collect, analyse, and use data to improve farm management, productivity, sustainability, and animal welfare. They support better decisions by turning real-time information into targeted actions.

WHY CATEGORISE DATSSs?

DATSSs cover a wide range of technologies, from sensors and robots to decision support platforms.

Categorisation helps users understand:

- What problem each technology solves
- How it is used on the farm
- How different tools work together

Livestock Farming DATs

Feed & Live Weight Measurement

Purpose: Optimise feeding and track growth.

Simple explanation: Feed and live weight measurement checks how much food animals eat and how much they weigh, helping you feed them properly and help them grow in a healthy way.

Examples:

Precision feeders

Precision feeders give each animal the right amount of food automatically, helping them grow healthy and reducing waste.



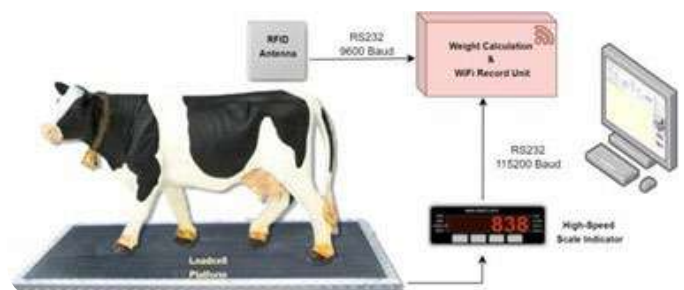
Feed intake monitoring

Feed intake monitoring watches how much each animal eats, helping you feed them correctly and keep them healthy.



Automated weighing

Automated weighing measures the weight of animals by itself, helping you know their growth and health without doing it manually.



WHY DATs MATTER?

DATs help to:

Increase
productivity



Improve
environmental
sustainability



Reduce costs
and operational
risks



Protect soil health
and animal welfare



Support evidence-based
farm management
decisions



Want to learn more?

The benefits of DATs are analysed in detail in:

- DATs in crop farming systems [link to paper](#)
- DATs in livestock farming systems [link to paper](#)

WHAT ARE DATSSs?

Digital Agricultural Technology Solutions (DATSSs) are digital tools, systems, and platforms that collect, analyse, and use data to improve **farm management, productivity, sustainability, and animal welfare.**

They support better decision-making by turning **real-time information** into **targeted actions** on the farm.

WHAT IS FEED & LIVE WEIGHT MEASUREMENT?

Feed & Live Weight Measurement is a category of **Livestock Farming DATSSs** that helps farmers **optimise feeding strategies and monitor animal growth.** These tools measure how much animals eat and track their body weight, supporting proper nutrition, healthy development, and efficient production.

Their purpose is to ensure that each animal receives **the right amount of feed** while enabling farmers to monitor performance and health in a structured and automated way.

WHO IS IT FOR?

Feed & Live Weight Measurement systems are designed for:



Livestock Farmers and Farm Managers seeking to optimise feeding and growth performance



Advisers and Extension Services supporting nutrition and animal management



Agricultural Consultants and Digital Innovation Hubs (DIHs) promoting livestock digitalisation



Researchers and Stakeholders analysing precision livestock farming practices

They are applicable to different dairy farm sizes and production systems.

KEY OBJECTIVES

To optimise feeding practices and reduce feed waste

To monitor animal growth and performance accurately

To increase productivity and production efficiency

To support animal health and welfare

To enable evidence-based livestock management decisions

MAIN FEATURES

Feed & Live Weight Measurement technologies focus on monitoring feed intake and animal growth:

Precision feeders

Automatically provide each animal with the appropriate amount of feed, supporting healthy growth and reducing waste.

Automated weighing systems

Measure animal weight automatically, allowing farmers to track growth and health without manual handling.

Feed intake monitoring

Track how much each animal consumes, helping ensure correct feeding and early detection of potential health issues.

Together, these technologies help livestock farmers improve feed efficiency, monitor animal development, and support sustainable and productive farming systems.

WHAT ARE DATSs?

Digital Agricultural Technology Solutions (DATSs) are digital tools, systems, and platforms that collect, analyse, and use data to improve farm management, productivity, sustainability, and animal welfare.

They support better decision-making by turning real-time information into targeted actions on the farm.

WHAT IS ANIMAL HEALTH, WELFARE & MONITORING?

Animal Health, Welfare & Monitoring is a category of Livestock Farming DATSs that focuses on protecting animal health and detecting problems at an early stage.

These technologies monitor animal behaviour and physiological parameters, helping farmers identify signs of disease, stress, or reproductive readiness before visible symptoms appear.

Their purpose is to support preventive livestock management, improve welfare, and maintain healthy and productive animals.

WHO IS IT FOR?

Animal Health, Welfare & Monitoring technologies are designed for:



Livestock Farmers and Farm Managers aiming to improve animal health and welfare



Advisers and Extension Services supporting preventive health management



Agricultural Consultants and Digital Innovation Hubs (DIHs) promoting precision livestock farming



Researchers and Stakeholders analysing animal health and welfare monitoring practices

They are applicable across different livestock species and production systems.

KEY OBJECTIVES

To detect health problems and stress early

To improve animal welfare and living conditions

To reduce disease risks and associated losses

To support reproductive management and productivity

To enable evidence-based livestock management decisions

MAIN FEATURES

Animal Health, Welfare & Monitoring technologies focus on continuous observation and analysis of animal condition:

Wearable sensors

Track animal health, activity, and behaviour, helping farmers identify illness or stress.

Temperature sensors

Collect body temperature data to identify early signs of sickness.

Activity trackers

Monitor movement and behavioural patterns to detect changes linked to health or welfare issues.

Oestrus detection systems

Identify when female animals are ready to breed, supporting improved reproduction efficiency and farm productivity.

Together, these technologies help farmers **monitor animals continuously, prevent health issues, and improve welfare**, supporting **sustainable and productive livestock farming systems**.

STORYBOARD

To complement the project's quantitative findings, TNO developed a series of farmer storyboards illustrating how different behavioural and contextual factors influence decisions related to the adoption of Digital Agriculture Technologies (DATs). Each storyboard presents a fictionalised farmer profile based on insights gathered from real-life farm settings and project data. The narratives highlight how elements such as farm structure, economic considerations, advisory support, personal attitudes, and perceived risks can shape farmers' decision-making processes.

SECURING THE LEGACY THROUGH DIGITALISATION



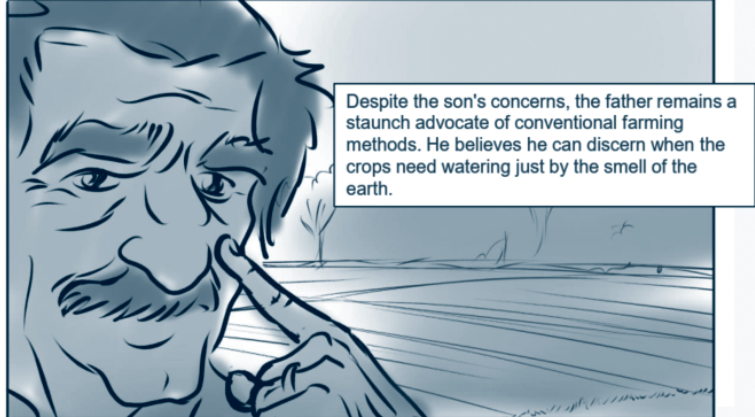
As he takes in the vista, the son allows his mind to wander, imagining a future where advanced technology intertwines with the rural charm of their farm, as he has seen at a recent visit to another farm.



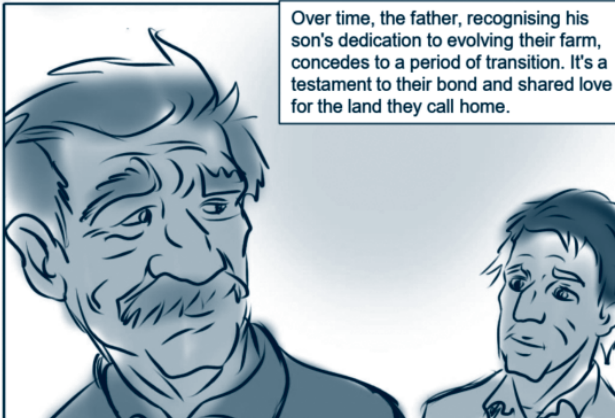
His eyes light upon his children, laughter ringing through the open fields. He pictures them inheriting a farm that beautifully marries tradition and modernity, nurturing it into a model of sustainable agriculture.



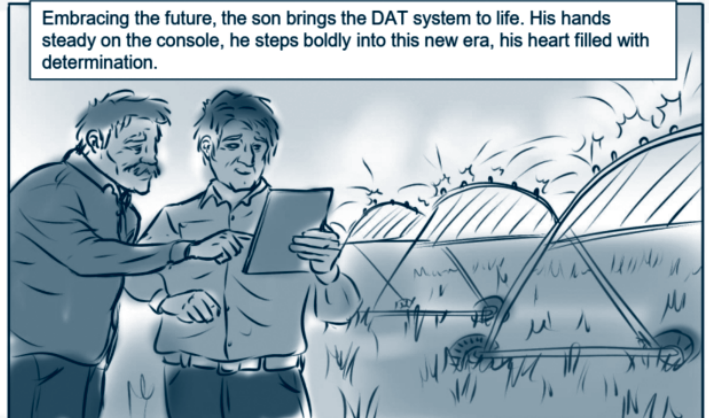
Yet, a sense of unease lurks in the son's heart, as he contemplates the daunting challenges on the horizon.



Over time, the father, recognising his son's dedication to evolving their farm, concedes to a period of transition. It's a testament to their bond and shared love for the land they call home.

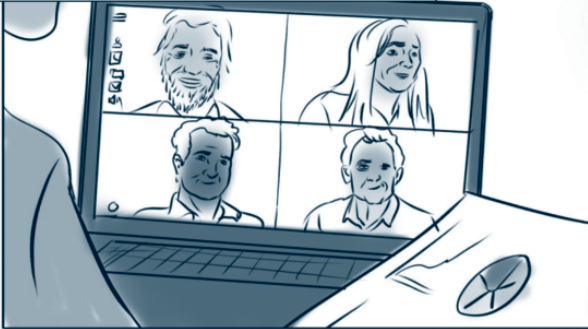


Embracing the future, the son brings the DAT system to life. His hands steady on the console, he steps boldly into this new era, his heart filled with determination.



Securing the legacy through digitalisation

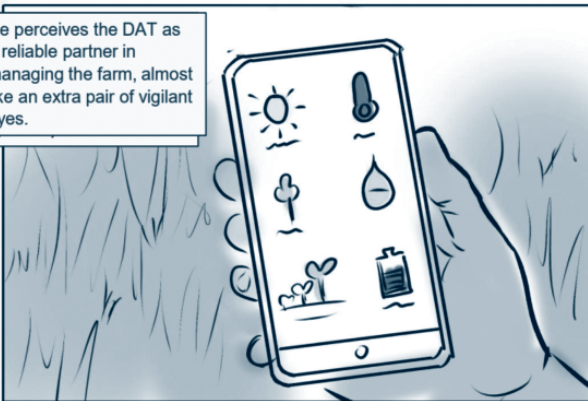
An inquisitive spirit propels him forward. He seeks knowledge, makes connections, ready to learn from the experiences of other farmers and experiment with new farming methods.



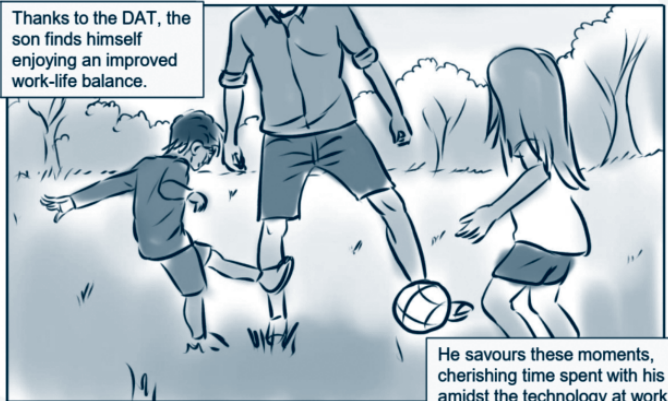
As he observes the transformation brought by the DAT system, a sense of confidence fills him. He watches as technology reshapes their farming process, seeding a new tomorrow in their ancient soil.



He perceives the DAT as a reliable partner in managing the farm, almost like an extra pair of vigilant eyes.

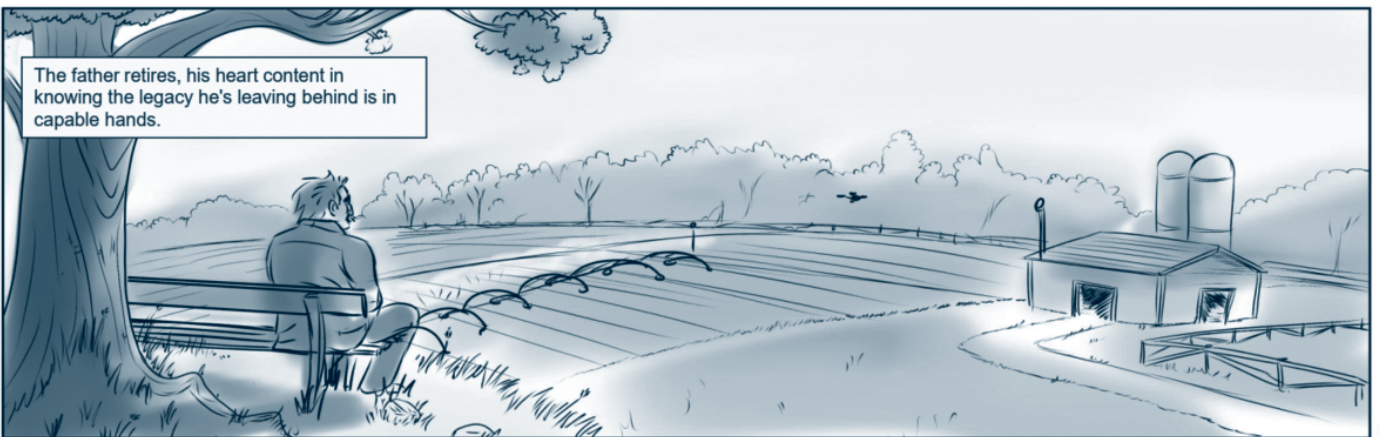


Thanks to the DAT, the son finds himself enjoying an improved work-life balance.



He savours these moments, cherishing time spent with his family amidst the technology at work.

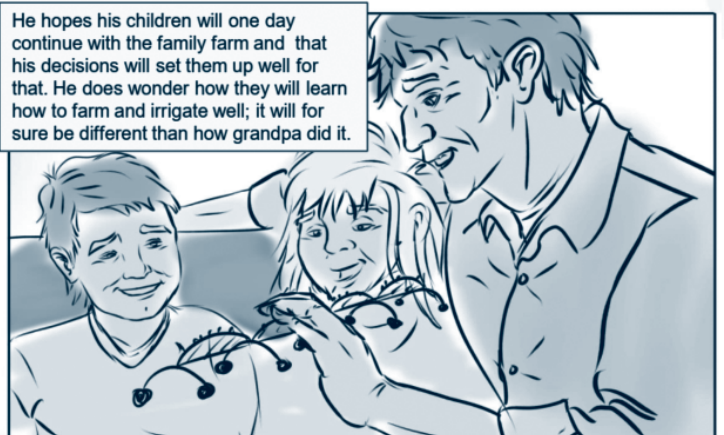
The father retires, his heart content in knowing the legacy he's leaving behind is in capable hands.



Although the pressures of farming are still there, first and foremost the ever-longer periods of drought, the son does perceive the difference of far more targeted irrigation. He decides to invest in the system for the longer term.

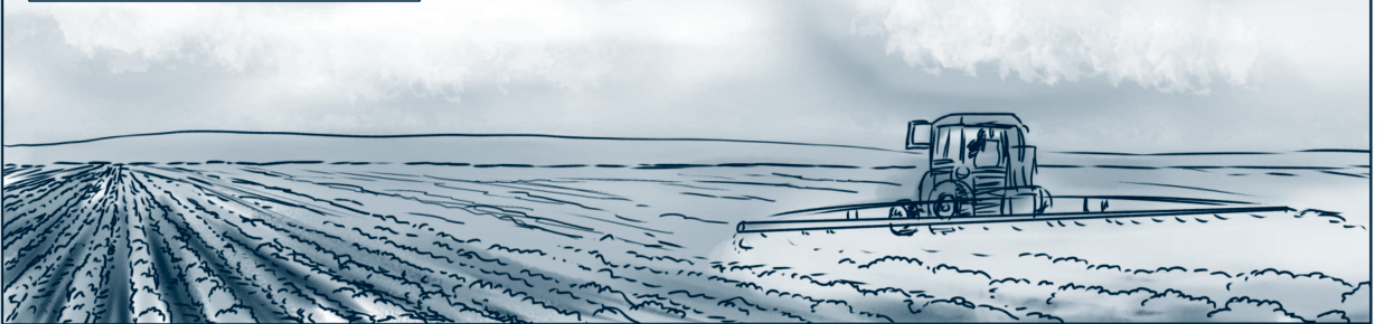


He hopes his children will one day continue with the family farm and that his decisions will set them up well for that. He does wonder how they will learn how to farm and irrigate well; it will for sure be different than how grandpa did it.



DIGITAL AUTONOMY

In North-West Europe lies a vast potato farm, tended by a seasoned farmer, his wife, their seasonal staff, and a trusted advisor.

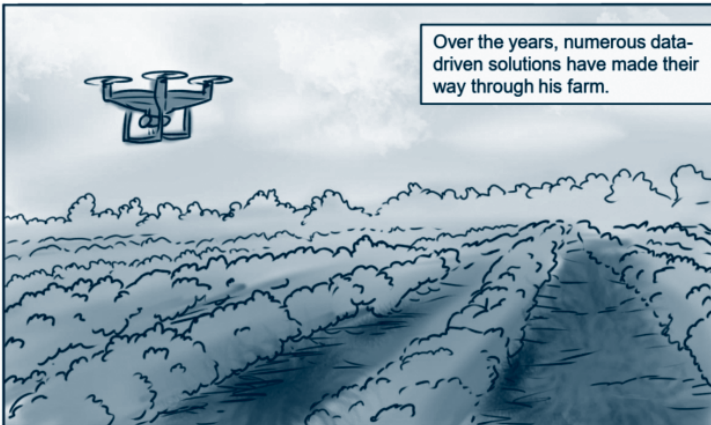


A familiar face in EU-led digital farming initiatives, the farmer balances innovation and tradition in his everyday life.

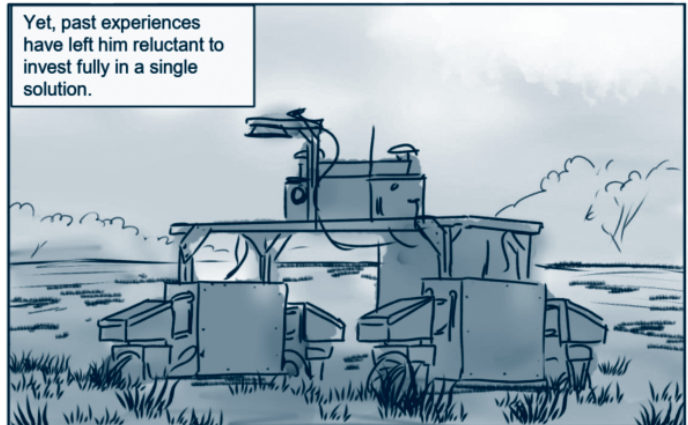


With an affinity for innovation and research, the farmer pilots new farming technologies, which also offers an additional stream of income.

Recently, he was invited to join a pilot program, a venture into advanced crop management supported by a DAT provider.



Over the years, numerous data-driven solutions have made their way through his farm.



Yet, past experiences have left him reluctant to invest fully in a single solution.



No technology yet could replace his intimate knowledge of the land, prompting him to always double-check.



And while recognising the potential for input reduction, he fears the constraints of committing fully to a DAT, also with this one that he piloted.

He wonders about the fate of the data his farm produces.



And what if the decision support fails? Where would he stand then?



Could this make him too dependent on a specific DAT supplier?

Unfortunately, his trusted advisor is unable to clear his doubts.

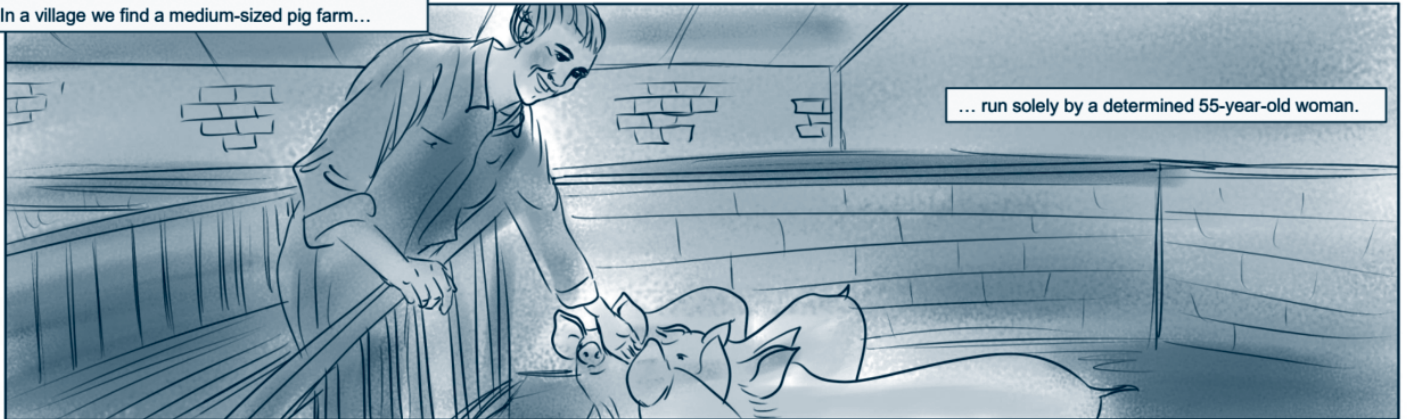


His wife, his equal in all decisions, agrees. They need clarity before committing to such an investment.



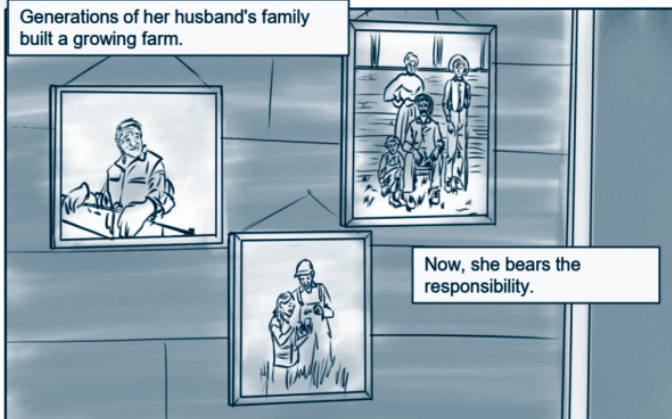
ARDENT AND PRUDENT PIG FARMER

In a village we find a medium-sized pig farm...



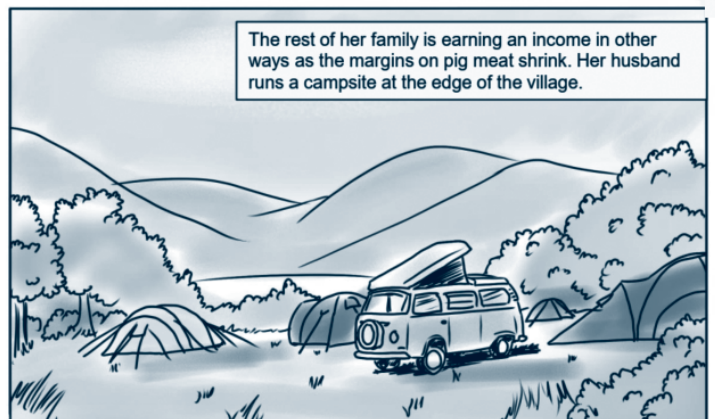
... run solely by a determined 55-year-old woman.

Generations of her husband's family built a growing farm.



Now, she bears the responsibility.

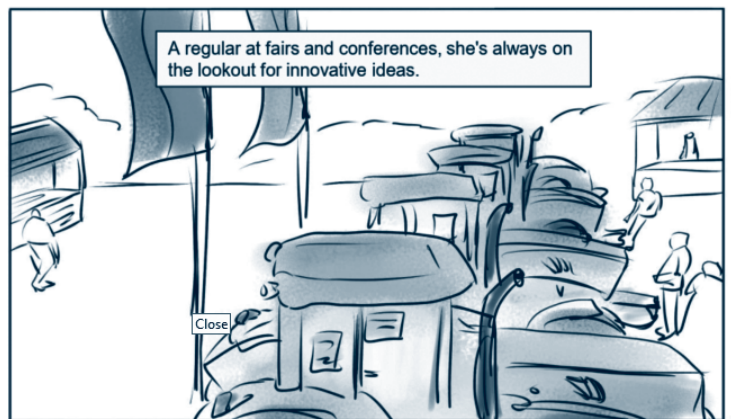
The rest of her family is earning an income in other ways as the margins on pig meat shrink. Her husband runs a campsite at the edge of the village.



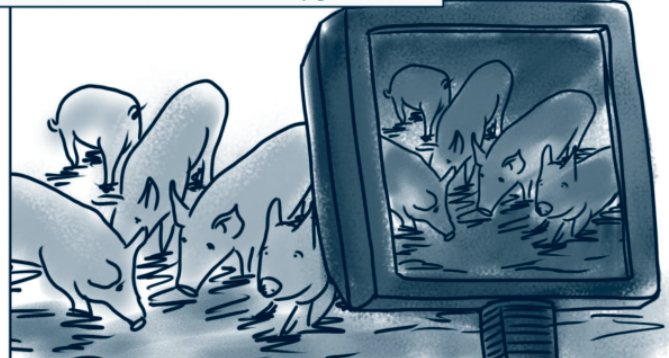
Apprehensive about market prices, she contemplates ways to cut costs, especially antibiotics.



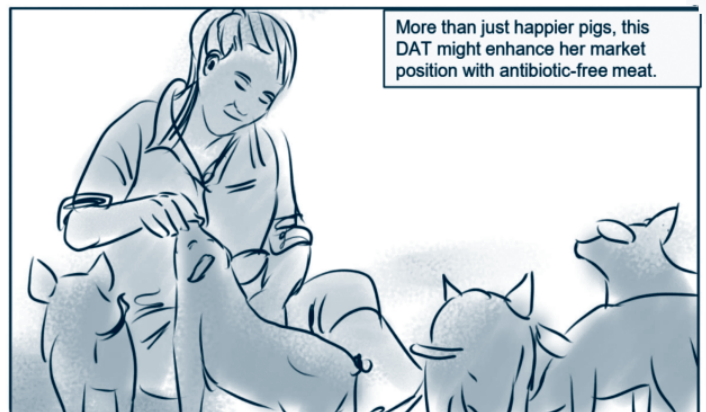
A regular at fairs and conferences, she's always on the lookout for innovative ideas.



An encounter at a fair unveils a DAT promising reduced antibiotics use, and healthier pigs.



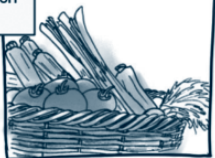
More than just happier pigs, this DAT might enhance her market position with antibiotic-free meat.



Ardent and prudent pig farmer

The Organic Farmer

The government pushes for sustainability. She feels however that they are more focused on mending market failures through subsidies, which she does not want to make use of.



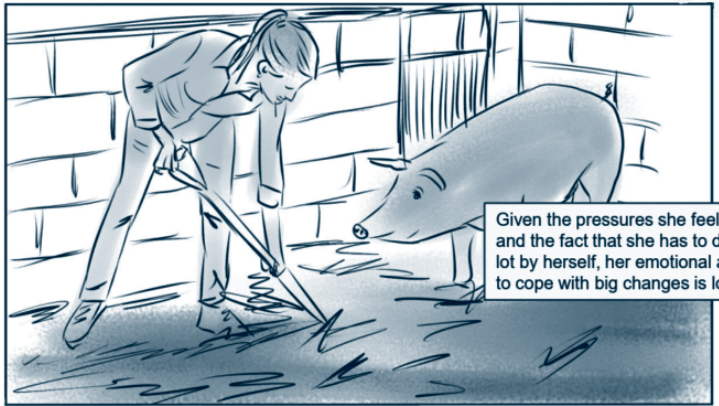
Just a few kilometers away, life seems easier where rules are less tight.



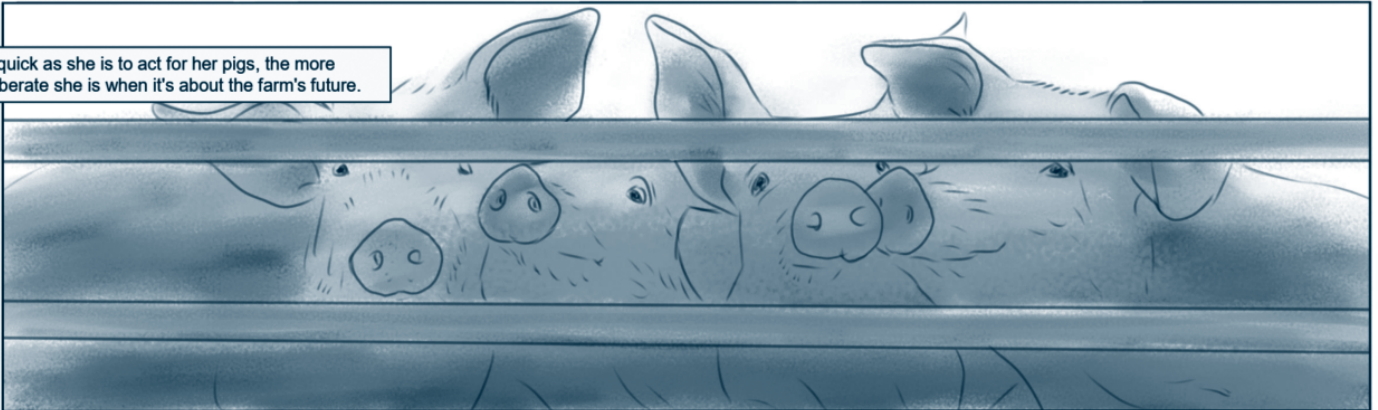
The decision to invest in a DAT isn't easy. She's cautious about spending in these volatile times.



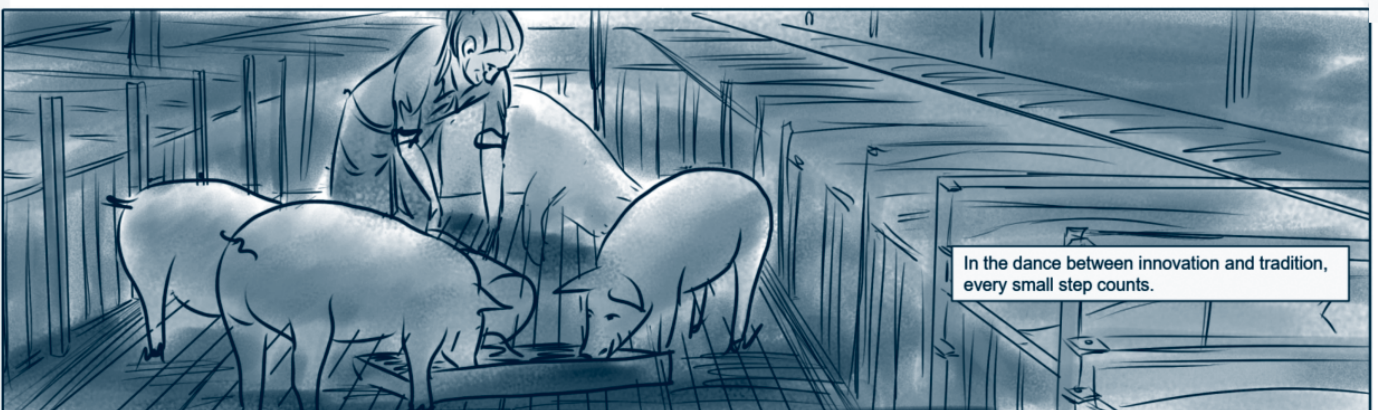
Given the pressures she feels, and the fact that she has to do a lot by herself, her emotional ability to cope with big changes is low.



As quick as she is to act for her pigs, the more deliberate she is when it's about the farm's future.

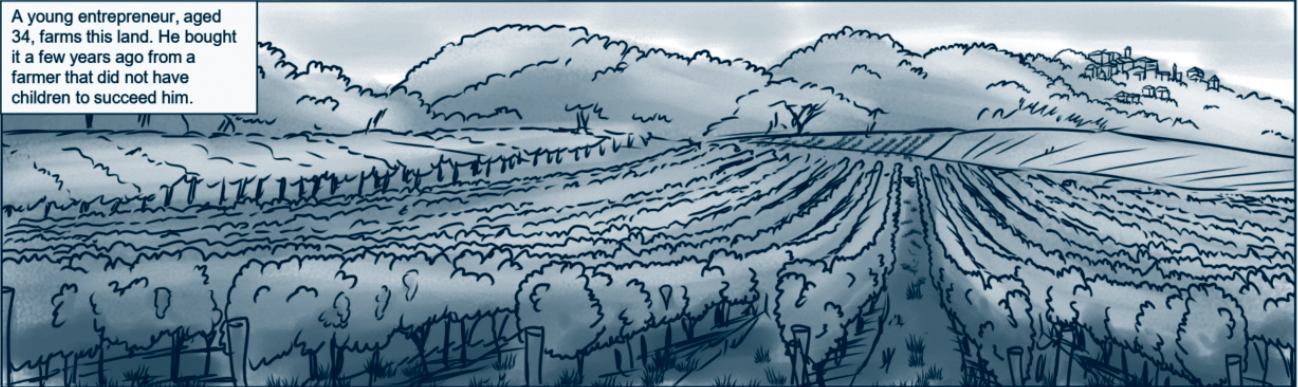


In the dance between innovation and tradition, every small step counts.



BUSINESS MENTALITY

A young entrepreneur, aged 34, farms this land. He bought it a few years ago from a farmer that did not have children to succeed him.



He loves being outside, reaping the fruits of his labour and enjoying the wine from his vines.



Yet at the same time he is a business man; just the way he was educated as an economically savvy agronomer at the local university.



He has a winery on location where he started to bottle his own wines and host tastings.

Despite some political instability that sometimes polarises his relatively poor region, he has a strong love for its local heritage.

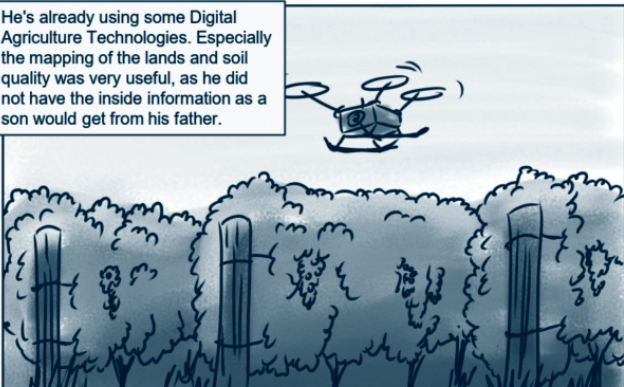


This results in a desire to preserve the region's nature and local culture. He is convinced DATs can actually help to do so, for instance by helping to recultivate indigenous types of grapes.

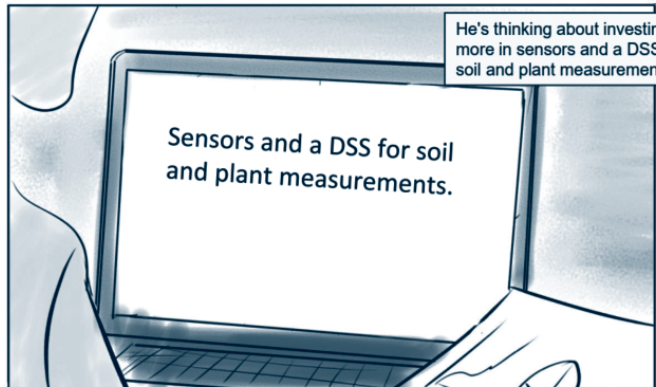
He feels that farmers his age understand him more than the older farmers in the region, who like to keep things as they are.



He's already using some Digital Agriculture Technologies. Especially the mapping of the lands and soil quality was very useful, as he did not have the inside information as a son would get from his father.



He's thinking about investing more in sensors and a DSS for soil and plant measurements.





He has the funds to invest, but the price tag is high.



His partner prefers to wait a while for the DATs to develop more. What if the technology fails?



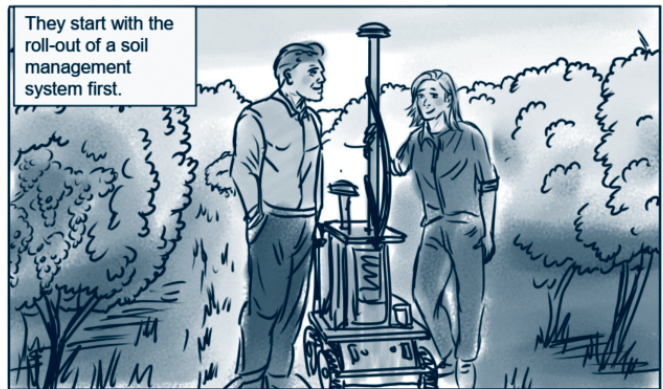
And what if his peers think lesser of him if it fails?



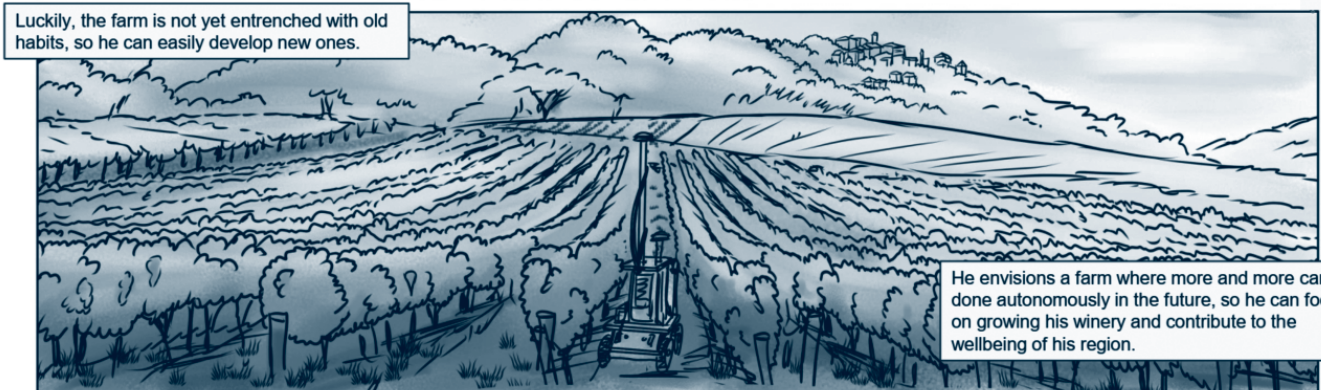
With rational arguments, such as a potential cost-benefit analysis and weighing of pros and cons as he learned in school, he overcomes these doubts.



He teams up with a well-known DAT supplier.



They start with the roll-out of a soil management system first.



Luckily, the farm is not yet entrenched with old habits, so he can easily develop new ones.

He envisions a farm where more and more can be done autonomously in the future, so he can focus on growing his winery and contribute to the wellbeing of his region.

NON-ADOPTER IN DOUBT

Meet a 43-year-old farmer with a family-owned farm.



They sell meat to supermarkets and also have a local farm shop.



Their farm also educates children about how food is produced.



The farm is a community favorite and everyone's welcome.

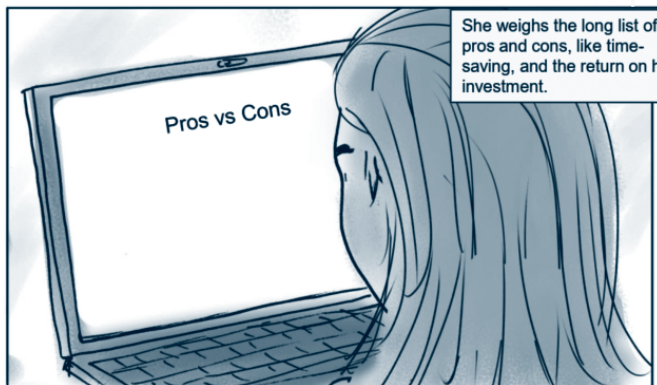
She wants to go organic, as she feels the urge to align with the community values of leaving the next generation a healthy planet.



She's burdened though by the rules from the supermarket chain and the proof she needs to collect of how she farms.



An advisor suggests new technology to help with certification and feeding.

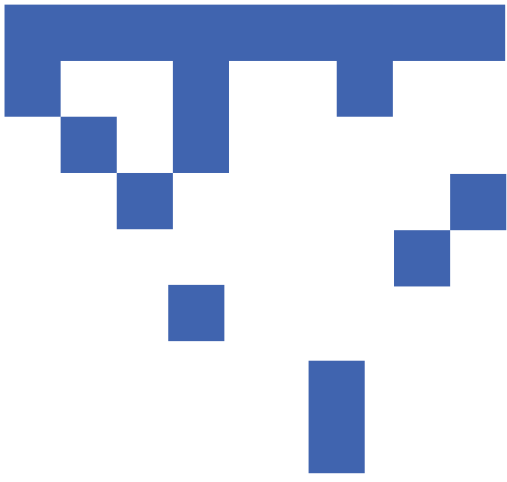


She weighs the long list of pros and cons, like time-saving, and the return on her investment.



These materials were presented at the CIOSTA Conference in Évora, Portugal, where they stimulated discussion among researchers, advisors, and stakeholders on the behavioural dimensions of digitalisation in farming.

Credits: **TNO** innovation for life



POLICY PATHWAYS



Seven cross-cutting Policy Pathways translate these themes into actionable guidance, focusing on:

- Long-term policy stability
- Targeted financial incentives
- Strengthened advisory and training systems
- Improved data governance and trust
- Reduced regulatory fragmentation
- Enhanced stakeholder collaboration
- Alignment with broader societal and value-chain objectives

Together, these features provide **holistic, behaviourally informed guidance** to help policies move from a “**technology push**” to a “**farmer-centred behavioural pull**”, supporting sustainable and effective DATSs adoption.

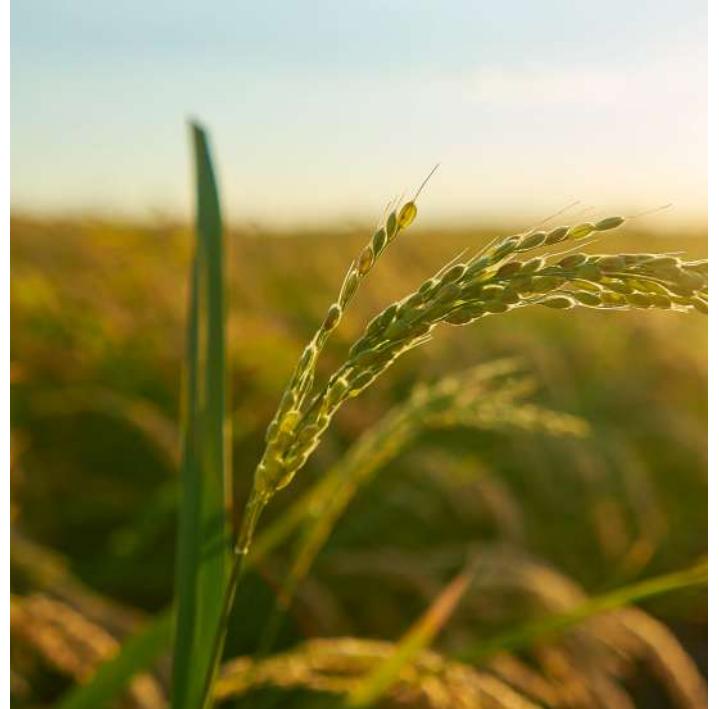
7 Pathways to Digital Progress

Behaviourally aware recommendations for EU agricultural policy.

A synthesized, behavior-informed roadmap to increase DATs adoption by addressing psychological and social barriers.

A set of seven policy pathways was developed and visually presented by TEAGASC to support the uptake of Digital Agriculture Technologies (DATs) in Europe. These pathways drew on behavioural insights and evidence gathered throughout the project.

They highlighted key areas where policy can create a more supportive environment for digital adoption in agriculture, including policy stability, advisory and training systems, data governance and trust, and stronger stakeholder collaboration across the agricultural innovation ecosystem.



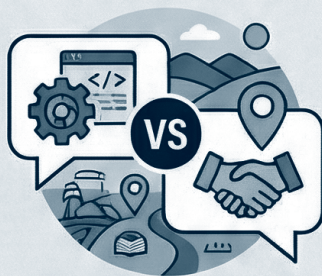
ESTABLISHING LONG-TERM POLICY STRATEGIES FOR AGRICULTURAL INVESTMENT

BARRIERS TO DIGITAL ADOPTION



FINANCIAL AND POLITICAL UNCERTAINTY

High upfront costs and shifting political leadership create investment risks for farmers.



TECHNICAL SPECS VS. REGIONAL CONTEXT

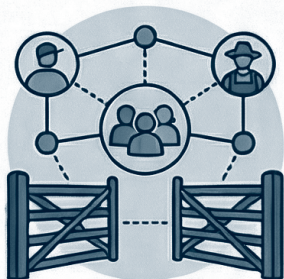
Farmers value regional familiarity and peer success over vendor marketing or technical specifications.



THE NEED FOR "SOCIAL PROOF"

Farmers require evidence from trusted, local sources before committing to long-term digital investments.

STRATEGIC POLICY RECOMMENDATIONS



FUND PEER-TO-PEER LEARNING NETWORKS

Prioritize funding for demonstration farms where farmers see digital tools successfully implemented



ALIGN WITH LONG-TERM EU VISIONS

Strategies should mirror CAP Pillar II objectives and the UN Sustainable Development Goals



ENSURE TRANSPARENT COMMUNICATION

Build trust by providing clear information on the real implications of DATS adoption

TEST-CASE EVIDENCE



PORTUGAL: PEER-LED IRRIGATION

An arable farmer adopted precision irrigation only after observing it with regional peers



NETHERLANDS: PROFESSIONAL DIALOGUE

Arable farmers used peer networks to confirm management expertise through professional dialogue



GREECE: WORK-LIFE BALANCE

Young cotton farmers viewed digitalization as a tool to improve personal work-life balance

PROVIDE TARGETED FINANCIAL INCENTIVES AND SUPPORT FOR DATSS ADOPTION

A behavioral shift in policy—rewarding measurable benefits and absorbing the risks of experimentation to support small, mid-sized, and vulnerable farming groups.

Identifying the Barriers to Digitalization



Financial & Operational Risk Aversion

Farmers often fear operational failure and high upfront costs more than they value potential long-term gains.



The “Learning by Doing” Gap

Adoption is hindered when economic or environmental benefits are not immediately visible or credible to the farmer.



Under-represented Demographics

Small/mid-sized farms, women farmers, and young farmers face steeper financial hurdles in accessing digital tools.

Key Policy Recommendations



Shift to Performance-Linked Incentives

Move from hardware-only subsidies to incentives rewarding measurable results, such as input savings or productivity gains.



Implement Trial-Phase Risk Sharing

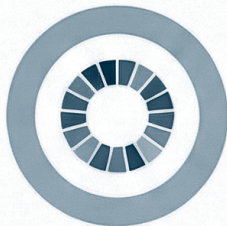
Use trial grants and “living labs” to allow farmers to experiment with new tools without financial penalties.



Targeted Grant Rates

Provide higher grant rates and CAP Pillar II support specifically for young and women farmers to ensure inclusivity.

Strategic Alignment



UN SDGs

Supports SDG 1 (Poverty), SDG 2 (Food Security), and SDG 5 (Gender Equality).



CAP Objectives

Directly supports Objective 1 (Viable Farm Income) and Objective 10 (Digitalization).



Pillar Support

Utilizes Pillar I (Eco-schemes) and Pillar II (Investment Support/Loans).

Real-World Test-Case Evidence



Germany

A dairy farmer adopted automated sensors after remote observation proved to reduce daily physical labour requirements.



Croatia

Seafood farmers used DATS as a logging mechanism to learn from mistakes and mitigate financial risks.



Ireland

Multi-season experimentation in “living labs” resulted in significantly higher long-term technology uptake than one-off training.

ENHANCING DATS ADOPTION THROUGH TRUSTED ADVISORY AND TRAINING SERVICES

Overcoming the digital trust gap and skills deficit to ensure effective use of Digital Agriculture Technology Solutions (DATSs) by EU Farmers

BARRIERS & BEHAVIOURAL INSIGHTS



The Digital Trust & Skills Gap

Lack of digital skills and trust are primary barriers to technology adoption in agriculture.

Advisors as Behavioral Gatekeepers

Farmers adopt tools when they see trusted advisors using digital outputs in routine consultations.



Advisor Anxiety

Advisors require continuous, funded training to overcome anxiety regarding rapid technological shifts.

POLICY RECOMMENDATIONS FOR DATS SUCCESS

Invest in the Digital Innovation Academy (DIA)



Fund training for advisors in both technical competence and behavioral communication skills.

Empower Independent Advisory Services



Ensure funding for objective, non-commercial assessments that farmers trust more than provider claims.

Prioritize Peer-to-Peer Learning



Support demonstration farms and farm walks to showcase tangible benefits in real-life conditions.

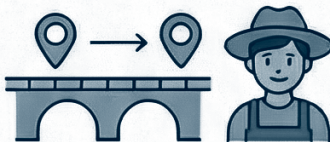
TEST-CASE EVIDENCE (EU Regions)



ROMANIA

Test Case Focus:
Data Security

Behavioral Insight/Finding:
Farmers required independent advisors to vouch for security due to political history.



ITALY

Test Case Focus:
Knowledge Gaps

Behavioral Insight/Finding:
Digital tools bridged critical gaps in farm history for young vineyard farmers.



PORTUGAL

Test Case Focus:
Implementation

Behavioral Insight/Finding:
Long-time trusted advisors were identified as the primary partners for navigating DATS.

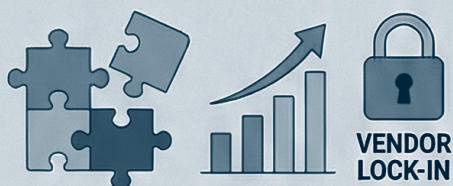
ADDRESSING REGULATORY FRAGMENTATION AND STANDARDISATION ISSUES

THE BARRIER: Cognitive Load & Regulatory Fragmentation

Administrative “Red Tape” Triggers Abandonment.



High Costs of Fragmentation.



Non-harmonised standards increase costs for providers and end-users while causing vendor lock-in.

Time Demands Cause Dropouts.



The digital environment shifts focus of farmers from land to desks.

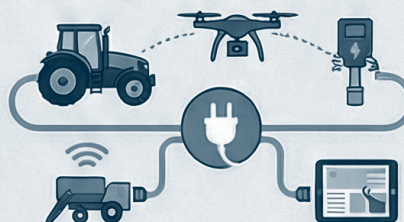
THE SOLUTION: Strategic Policy Recommendations

Simplify Applications.



Reduce administrative burdens in grant applications to prevent compliance reporting duplication.

Enforce “Plug-and-Play” Standards.






Incentivise interoperable standards and common data formats across all regional tools.

Farmer-Centric Technology Design.



Align technology design with real-time data use to reduce the administrative burden.

TEST-CASE EVIDENCE: Country-Specific Regulatory & Administrative Barriers

Country	Evidence Found
Spain	Arable farmers reported significant time loss due to administrative overhead. 
Belgium	Pig farmers found current subsidy schemes significantly complicated and difficult to navigate. 
Netherlands	Apple farmers viewed tools duplicating compliance reporting as obstacles to field work. 

IMPROVING DATA GOVERNANCE, PRIVACY AND TRUST IN AGRICULTURE

A framework for EU policymakers to address farmer concerns, enhance trust, and ensure economic value from data.



BARRIERS TO DATA ADOPTION & ECONOMIC AUTONOMY



STRATEGIC POLICY RECOMMENDATIONS



THE AUTONOMY GAP



Farmers resist tools perceived as externally controlling or prescriptive regarding data sharing and usage.



TRANSPARENT COMMUNICATION



Explicitly communicate how the EU Data Act protects farmers and aligns with GDPR.



COMPLEX REGULATORY FEAR



Unclear EU regulations like the AI Act create a fear of non-compliance among farmers.



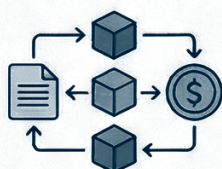
RELIABLE ADVICE & "FARMINARS"



Fund educational tools like webinars to help farmers review contracts and data governance.



ECONOMIC VALORISATION



A critical barrier is the lack of frameworks ensuring farm data is not given away for free.



FARMER-CENTRIC TECH DESIGN

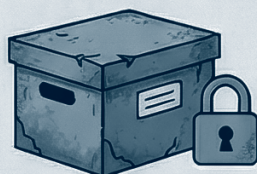


Ensure providers use transparent contract terms and explainable AI interfaces to build trust.



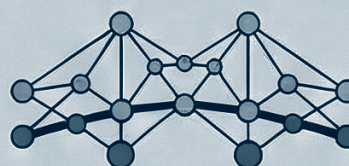
EVIDENCE FROM THE FIELD

ROMANIA: HISTORICAL DISTRUST



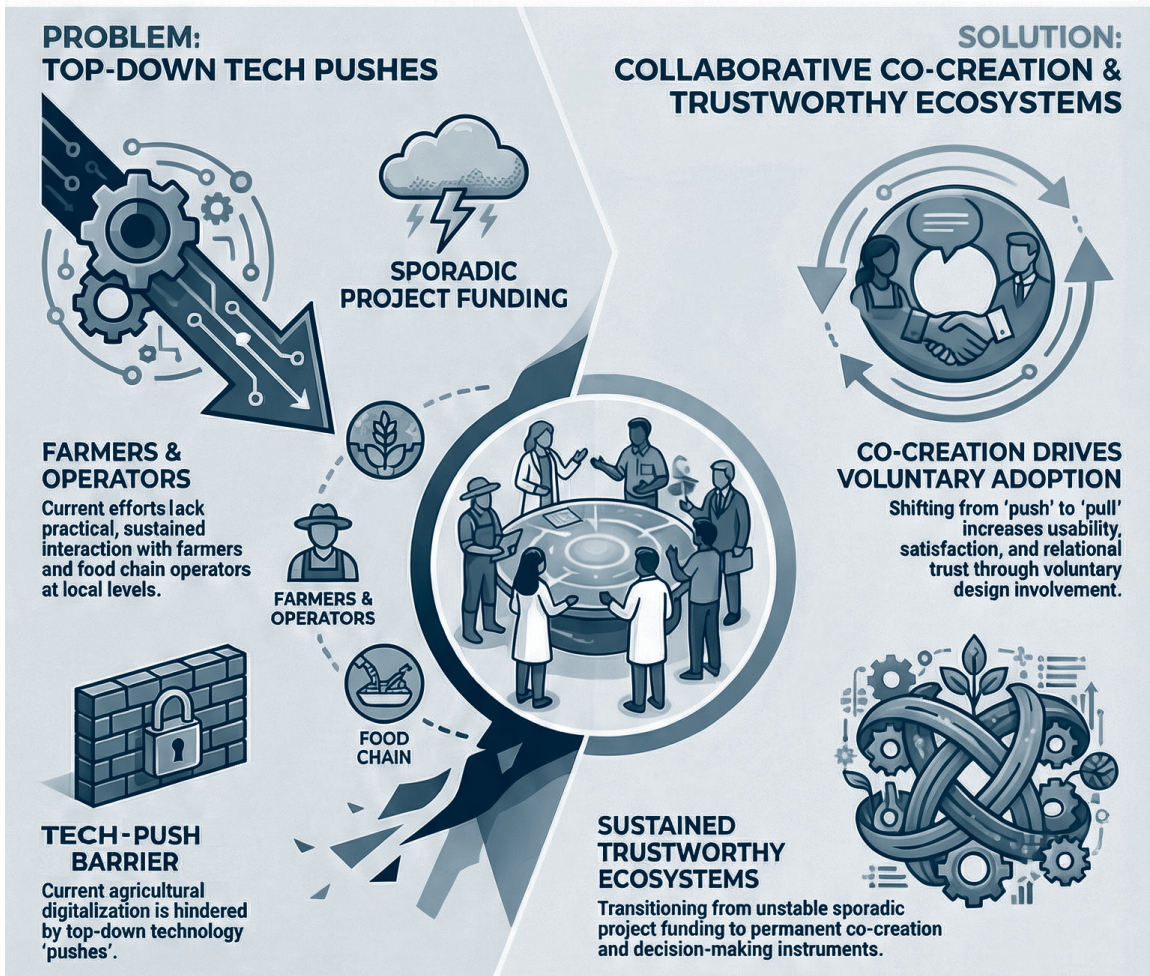
Resistance in test cases #10, #17, and #28 was linked to historical socialist-era distrust of authorities.

GREECE: STRATEGIC COORDINATION



Test case #4 highlights that a coordinated strategy is vital to prevent farmer "despair" over data hurdles.

PROMOTE COLLABORATION AND STAKEHOLDER INVOLVEMENT



KEY POLICY RECOMMENDATIONS

ESTABLISH NATIONAL FORUMS & SANDBOXES
Create national digital agriculture forums and regulatory sandboxes to test innovations in controlled environments.

ANNUAL YOUTH POLICY DIALOGUES
Formally include young farmers in regional and European decision-making processes regarding investment and policy.

MULTI-ACTOR APPROACH FUNDING
Continue funding projects that integrate public and private advisors into high-level decision-making.

TEST-CASE EVIDENCE

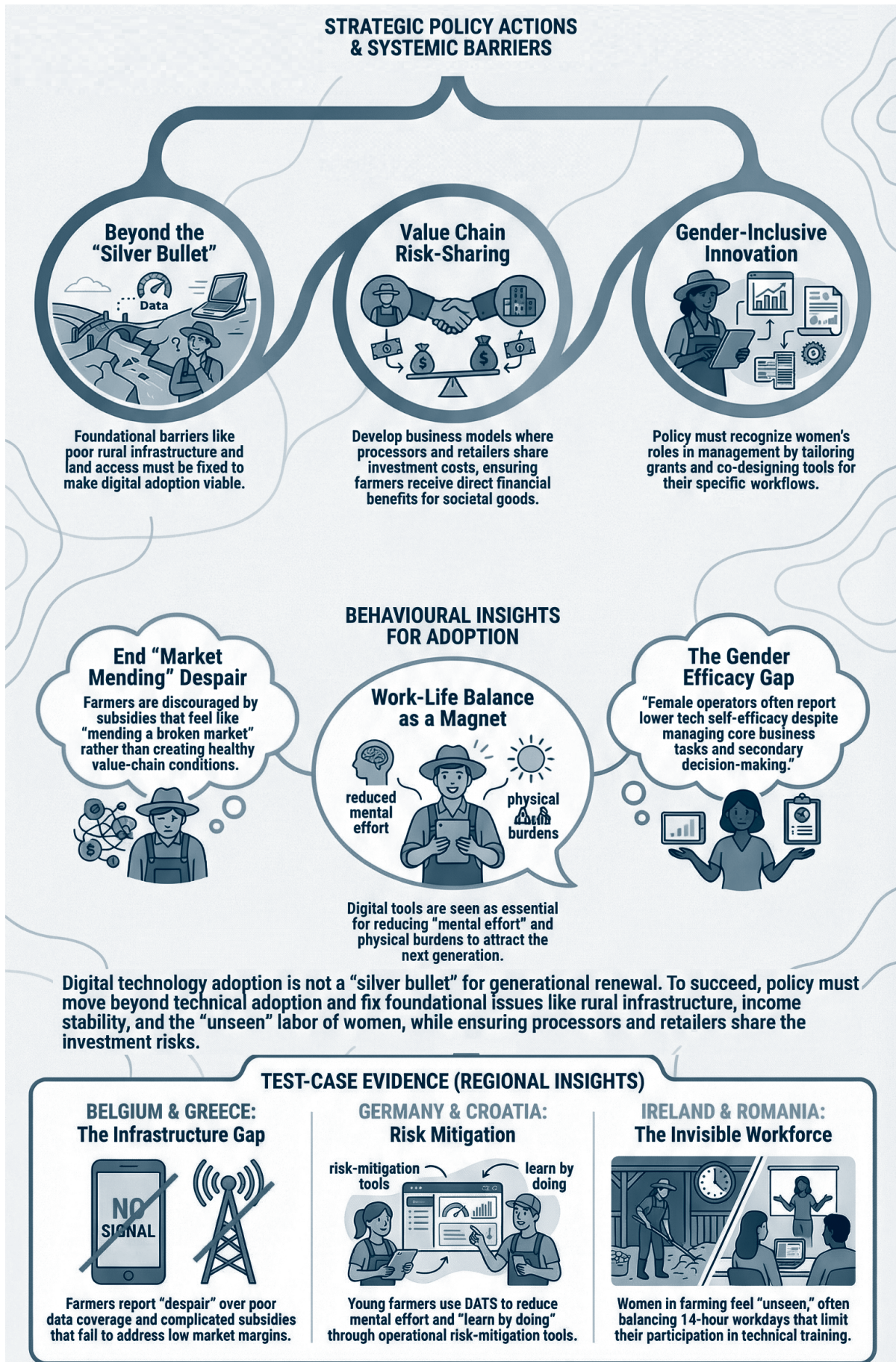
ITALY: BRIDGING THE GENERATIONAL GAP
Success relied on advisors and digital tools working together to transfer knowledge to young farmers.

IRELAND: THE 'LIVING LAB' ADVANTAGE
Multi-season experimentation in Living Labs led to significantly higher long-term uptake than one-off training.

BELGIUM: REDUCING FINANCIAL FEAR
Regulatory sandboxes allowed pig farmers to test high-risk innovations without solo financial exposure.

ADDRESSING BROADER SOCIETAL AND VALUE CHAIN ISSUES

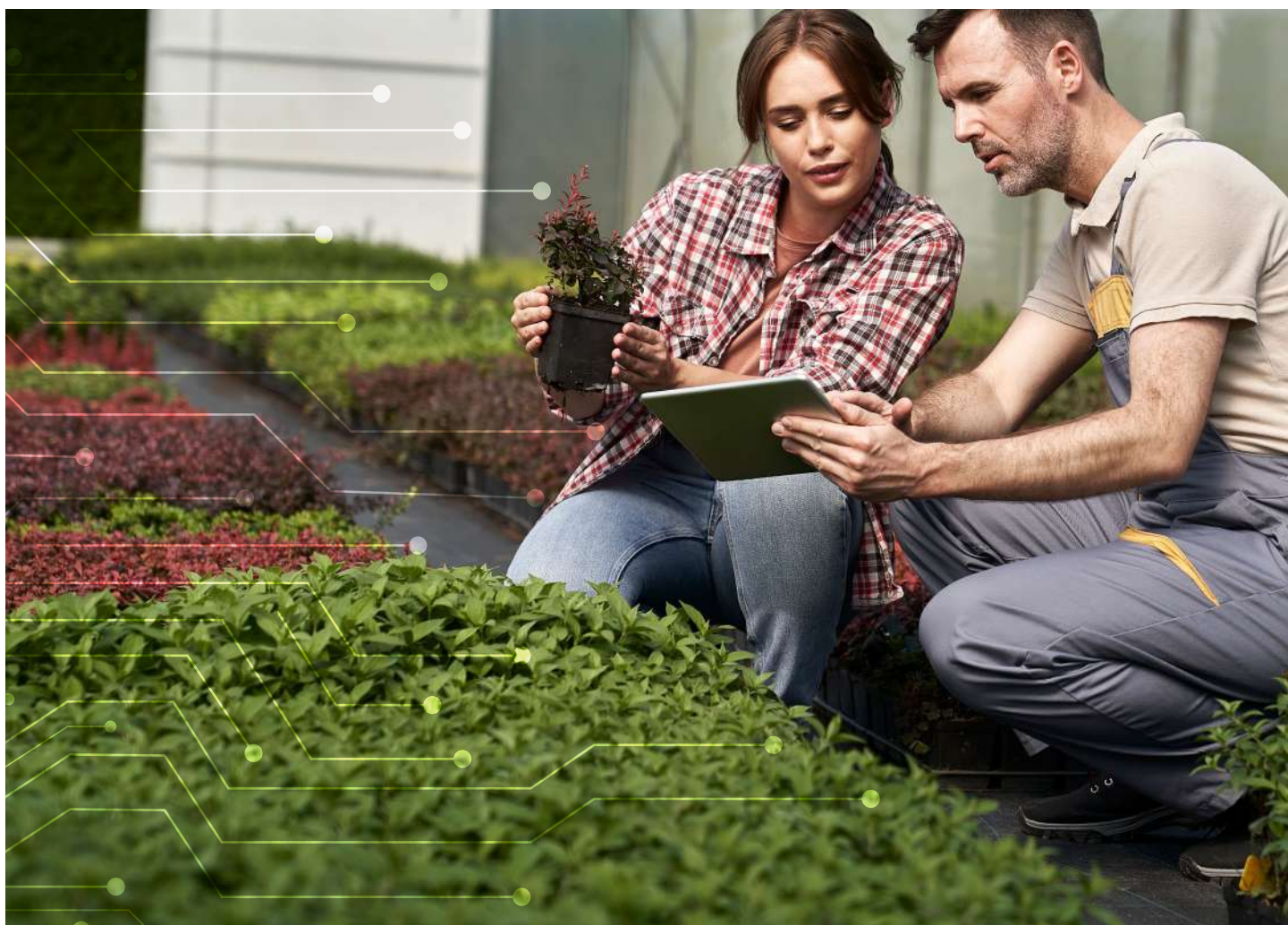
To inform EU policymakers that digital technology (DATS) adoption requires addressing systemic barriers-like infrastructure and gender inequity-through risk-sharing across the entire agricultural value chain.



Advancing Gender Equality in Agriculture and Rural Areas

This Policy Recommendations brief presents key findings from five Horizon Europe projects working to advance gender equality in agriculture and rural areas. Recognising that there is no single pathway to achieving gender equality, each project adopts a distinct approach to understanding and addressing the challenges faced by women and gender-diverse individuals engaged in agriculture or living in rural communities.

Despite these differences, the projects have collaborated to develop a shared perspective on the issue and to propose actionable, evidence-based solutions. These recommendations are summarised in the infographic below, highlighting key policy pathways to foster more inclusive, equitable, and resilient agricultural and rural systems.



5 STRATEGIC POLICY RECOMMENDATIONS FOR GENDER EQUALITY IN AGRICULTURE

This infographic outlines transformative policy pathways to address structural gender inequalities and promote leadership for women in rural and agricultural sectors. It emphasizes moving beyond simple technology adoption to investigate nuanced social and cultural norms, providing a roadmap for a more inclusive European agricultural sector.

1. Mainstream Gender Equality & Targeted Support

Implement a Dual Approach to Policy

Combine special measures, such as women-only entrepreneurship support, with the mainstreaming of gender equality across all rural and agricultural policies.



Strengthen Gender-Disaggregated Data

Revise data systems like Eurostat to accurately track farm ownership, partnerships, and roles in decision-making to enable better policy targeting.



Recognize and Reward Community Work

Formally remunerate women for building vital "invisible" infrastructure, such as childcare, social housing, and community libraries in remote regions.



2. Foster Innovation and Leadership

Promote Multifunctional, Locally-Led Innovation

Use initiatives like LEADER and the EU CAP network to enhance women's roles in driving competitiveness and resilience in rural economies.



Enhance Participation in Knowledge Systems

Strengthen women's involvement in Agricultural Knowledge and Innovation Systems (ANIS) to support their contributions to sustainability.



Challenge Stereotypes with Role Models

Disseminate success stories and guides of women-led innovations to inspire new generations and question masculine social norms.



3. Reform Policy and Funding Mechanisms

Conduct Rigorous Gender Analyses

Systematically analyze structural inequalities in access to CAP subsidies and integrate these findings into the design and monitoring of all interventions.



Apply Human Rights Impact Assessments

Use rights-based indicators to ensure that agricultural policies actively redress both direct and indirect forms of gender discrimination.



Remove Barriers to Grant Eligibility

Revise requirements so that funding is available to all members of a farm partnership, rather than just the registered sole-holder (often male).



4. Leverage Digitalization and Technologies

Prioritize Women in Tech Development

Fund technology solutions designed with women as primary users to ensure digital tools address their specific needs in farm management.



Close the Gendered Confidence Gap

Systematically include digital literacy and technology access to gender equality programs to empower women to adopt smart farming systems.



Promote Female Entrepreneurship in Agritech

Tailor training sessions to female learning styles and highlight female-led agritech successes through dedicated storytelling events.



5. Make Rural Areas Attractive for Young Women

Address Structural Access to Resources

Focus policy measures on removing obstacles to land access, decent work, and social security for young women and gender-diverse people.



Build Supportive Political Networks

Facilitate the creation of educational networks and peasant feminist organizations that provide gender-sensitive advice and counselling.



Improve Social Support Infrastructure

Ensure access to social security and fair market prices to make farming a viable and attractive career path for the next generation.



Accelerating the Digital Transition in European Agriculture:

Policy Pathways to Scale Digital Agricultural Technology Solutions (DATS)

Digital Agricultural Technology Solutions (DATS) are key enablers of a more competitive, sustainable, and resilient European agriculture. However, their uptake remains uneven across EU farming systems due to structural barriers, including limited access to finance, data governance concerns, interoperability challenges, and skills gaps.

Evidence from QuantiFarm test cases shows that DATS can significantly improve farm efficiency, resource use, animal welfare monitoring, and environmental performance. Yet, their adoption depends not only on technology availability but also on supportive, stable policy frameworks and viable business models.

This policy brief presents key insights and targeted recommendations to accelerate DATS uptake across Europe. It focuses on strengthening data governance and interoperability, enhancing advisory services and digital skills, enabling tailored financial instruments, and integrating digital solutions into the Common Agricultural Policy (CAP).

Together, these measures can create a coherent policy environment that supports innovation while keeping farmers at the centre of the digital transition.



POLICY PATHWAYS TO SCALE DIGITAL AGRICULTURE

QUANTIFARM RECOMMENDATIONS

The QuantiFarm project evaluated Digital Agriculture Technology Solutions (DATS) across 30 commercial Test Cases in 20 countries, finding significant improvements in farm efficiency, environmental performance and animal welfare. However, structural barriers like limited finance, data concerns and skills gaps hinder widespread adoption in Europe. To transition from a "technology push" to a "farmer-centered pull", QuantiFarm proposes four core policy recommendations, emphasizing a coherent mix of regulation, incentives and capacity building for successful digitalization intergrated into a European agricultural framework.

Priority 1: Data Governance & Interoperability



Establish Farmer-Centred Data Governance

Transparent rules regarding data ownership, access rights, and usage are essential to build trust and ensure fair participation for farmers in digital value chains.

Promote Interoperability Standards

Policy should encourage standardisation across machinery, software, and sensors to prevent technological lock-in and allow farmers to combine different digital solutions easily.

Develop the European Agricultural Data Space

This initiative aims to provide secure and efficient data sharing for specific use cases while maintaining farmers' control over their operational data.

Priority 2: Financial Conditions for Investment



Deploy Targeted Financial Instruments

Expanding access to low-interest loans, guarantees, and micro-financing can reduce the significant upfront investment risks that discourage small and medium-sized farms.

Implement Fiscal Incentives

Policies like tax incentives or accelerated depreciation for digital equipment can directly reduce investment costs for farmers adopting new technologies.

Support Alternative Financing Models

Encouraging leasing, "machinery-as-a-service" models, and cooperative investment schemes allows farms with limited capital to access advanced automated equipment.

Priority 3: Integration with the CAP



Unlock Potential via CAP Strategic Plans

Recognising DATS as enabling infrastructure within CAP plans can support digital solutions through rural development measures and pilot projects.

Enable Result-Based Policy Approaches

Precision equipment allows farmers to measure and document environmental outcomes, such as nutrient use efficiency and soil health, directly for CAP reporting.

Reduce Administrative Burden

Integrating digital tools into CAP monitoring and reporting systems improves the accuracy of assessments while simplifying the process for the farmer.

Priority 4: Skills and Advisory Capacity



Strengthen the AKIS Framework

Enhancing the Agricultural Knowledge and Innovation System (AKIS) ensures that digital adoption is supported by a robust network of advisors and researchers.

Coordinate a European Strategy for Digital Skills

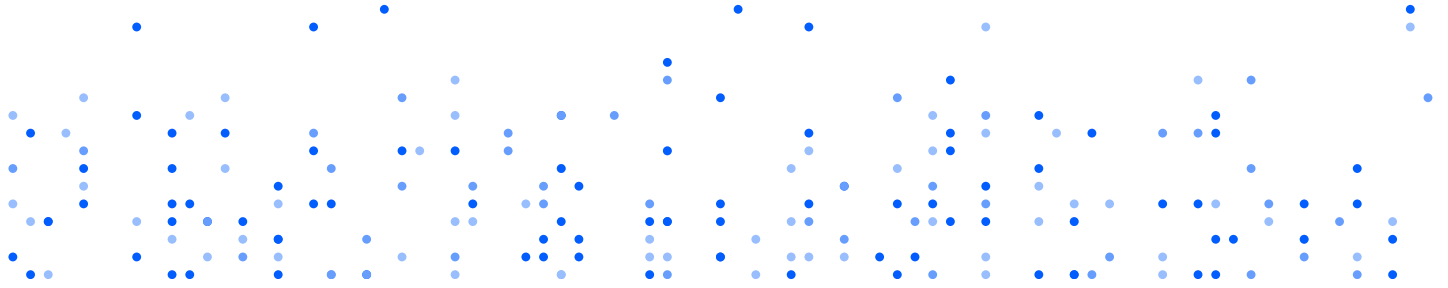
A unified strategy is needed to equip farmers, advisors, and rural professionals with the skills required to manage data-driven farming systems.

Promote Peer-to-Peer Learning

Demonstration farms and knowledge exchange networks are crucial for helping farmers learn practical strategies for integrating digital tools into daily operations.



Data-driven evidence. Farmer-centred innovation.
Policy-aligned digital transition.



COORDINATOR 

PARTNERS



GET IN TOUCH



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