QuantiFarm

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

Funded by the European Union

Project number: 101059700

Call: HORIZON-CL6-2021-GOVERNANCE-01

Type of action: HORIZON-RIA

Duration: 45 months (July 2022 - March 2026)

Funded by
the European Union

Contents

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.

30 Test Cases | **20** Countries | **10** Biogeographical Regions

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

115 Parcels engaged in testing activities

38 Different DATSs or combinations of DATSs

1 Policy monitoring tool

5 Decision support tools

20 Crop and livestock products

30 > 1000 Demo events with Direct participants

9 DATSs categories

Database with information for **>500** DATSs

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 most distinctive contributions was its **behavioural analysis of DATSs adoption.**

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

How	When & Why	Who	What
farmers evaluate digital tools	they adopt or reject them	influences these decisions (family, advisors, cooperatives, suppliers)	behavioural determinants shape long-term usage

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

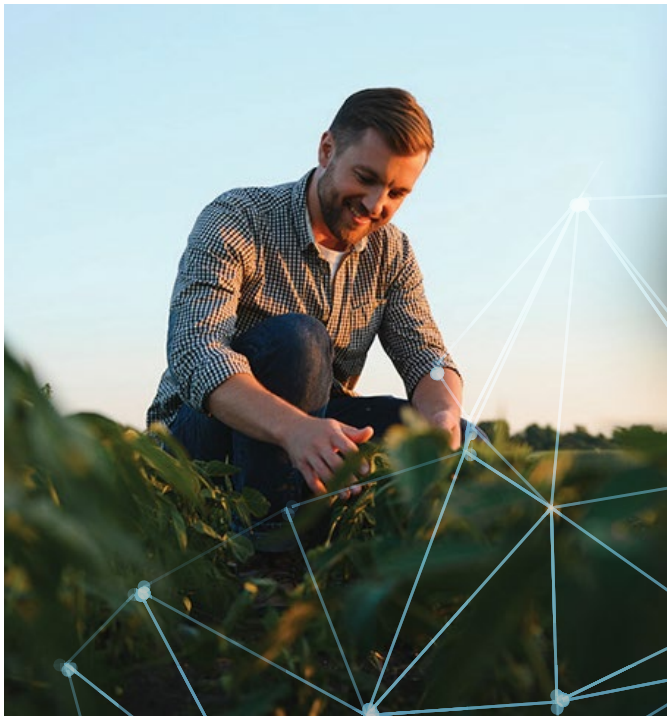
This analysis led to:

- Behavioural Determinants Reports
- Behaviour Intervention Recommendations

These findings informed:

- The design of the QuantiFarm Toolkit
- The structure of advisory services
- Policy recommendations for improving uptake

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, QuantFarm 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 **30 TCs** using the Assessment Framework

A sustainability and exploitation **Strategy**

A digital **Innovation Academy**

Policy recommendations

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

QuantiFarm

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 5 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 Agricultural 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 adoptt a DATSs

Researchers
to access harmonised evaluation methodologies

Advisors & Advisory Servivces
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

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 Servivces 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 livestock 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 levelss

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 & 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

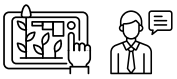
Together, these features **support systematic benchmarking and comparative analysis** of agricultural performance at parcel-level.

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

QuantiFarm

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 & 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 (wortkshop 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.

QuantiFarm

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.

Soil sensors

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

Yield mapping tools

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

Satellite and UAV imagery

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

Weather stations

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

Guidance / Controlled Traffic Farming (CTF)
Purpose: Guide machinery precisely and protect soil.

GPS auto-steering

Helps tractors drive accurately, saving time and fuel.

RTK guidance

Provides high-precision positioning for farm machinery.

Traffic lane planning system

Define optimal machinery paths to reduce soil compaction.

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 action**s 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 labourrequirements 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, & 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.

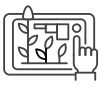
Their purpose is to **bring all relevant farm information together** and transform it into **useful recommendations and insights** for better crop management.

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 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 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 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.

WHY CATEGORISE DATSs?

DATSs 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 DATSs

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

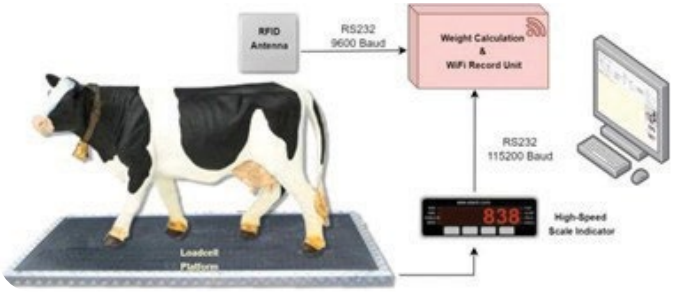
Precision feeders give each animal the right amount of food automatically, helping them grow healthy and reducing waste.

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 DATSs MATTER?

DATSs 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 DATSs are analysed in detail in:

DATSs in crop farming systems

DATSs in livestock 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 FEED & LIVE WEIGHT MEASUREMENT?

Feed & Live Weight Measurement is a category of **Livestock Farming DATSs** 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.

Activity trackers

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

Temperature sensors

Collect body temperature data to identify early signs of sickness.

Oestrus detection systems

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

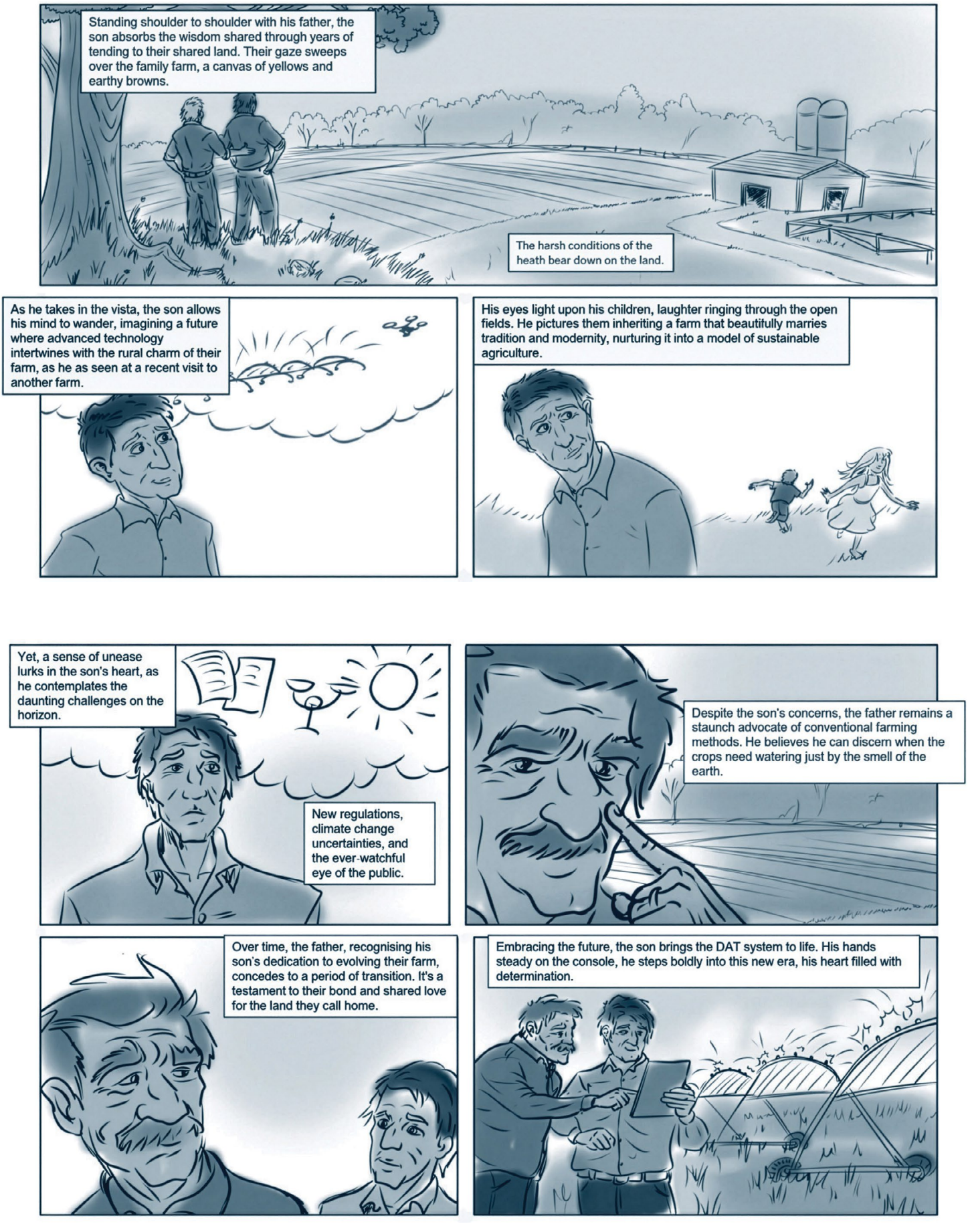
Together, these technologies help farmers **monitor animals continuously, prevent health issues, and improve welfare**, supporting **sustainable and productive livestock farming systems.**

QuantiFarm

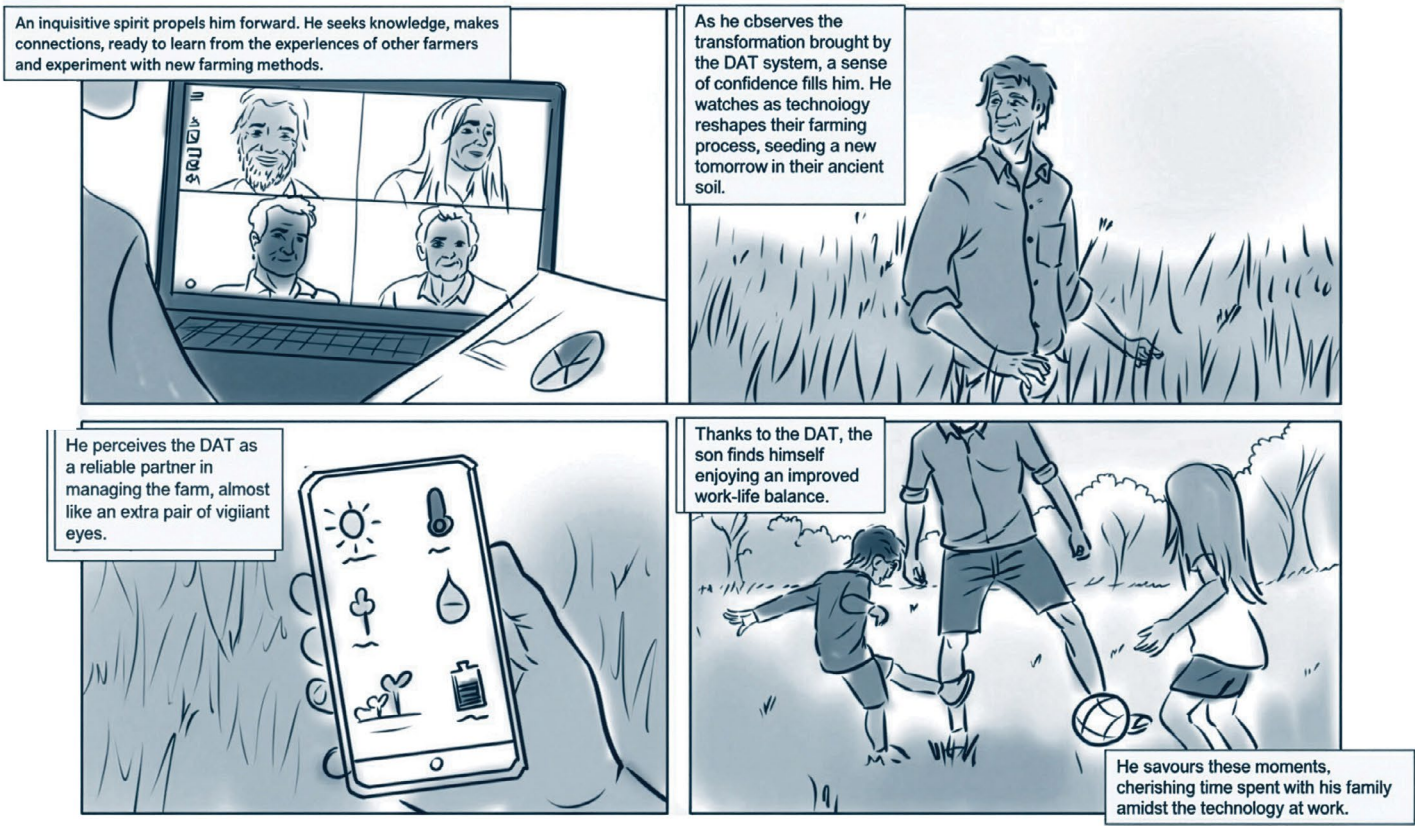
STORYBOARD

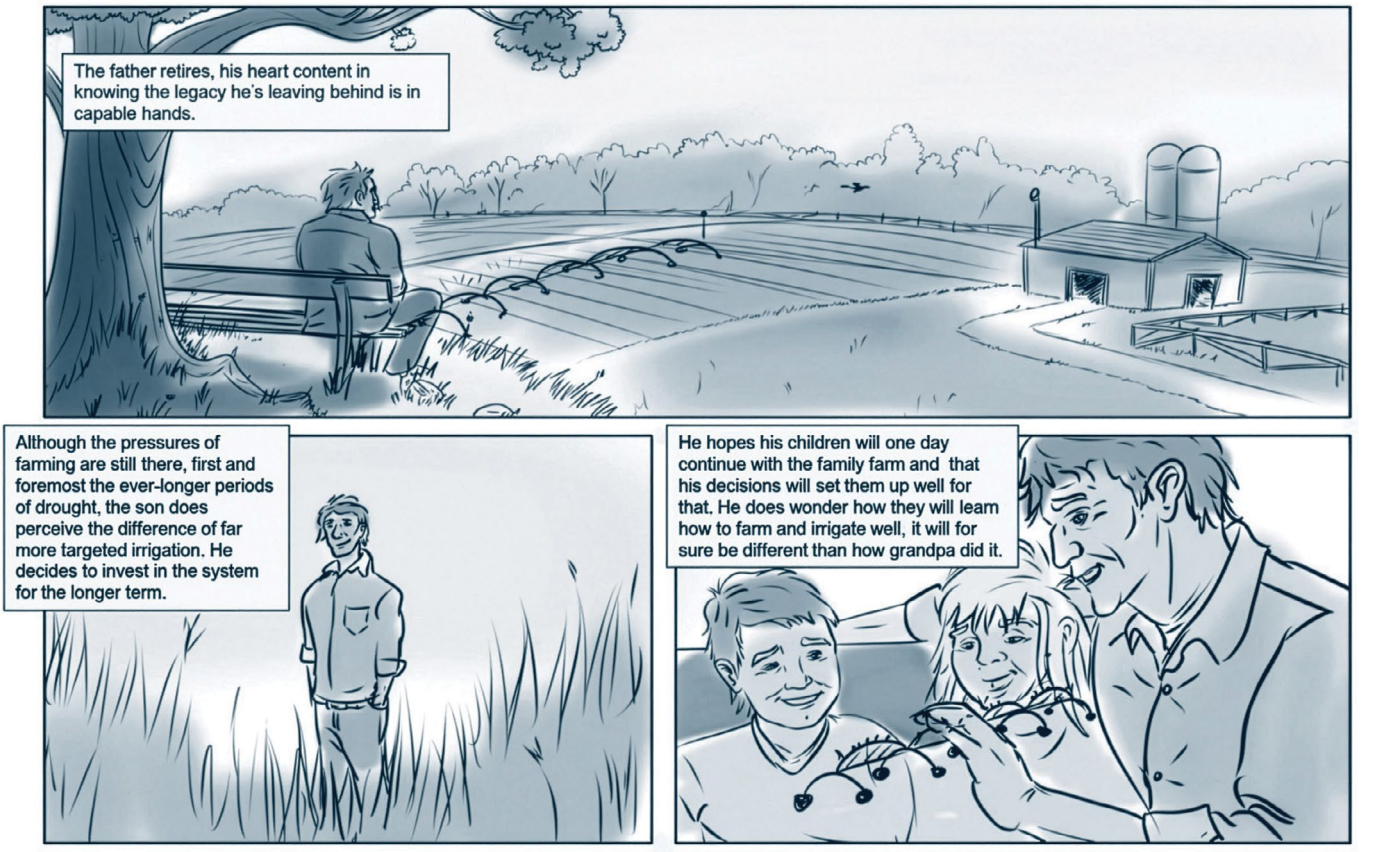
To complement the project's quantitative findings, TNO developed a series of farmer storyboards illustrating how different behavioural and contextual factors influence decisions related to the adoption of Digital Agriculture Technologies (DATs). Each storyboard presents a fictionalised farmer profile 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

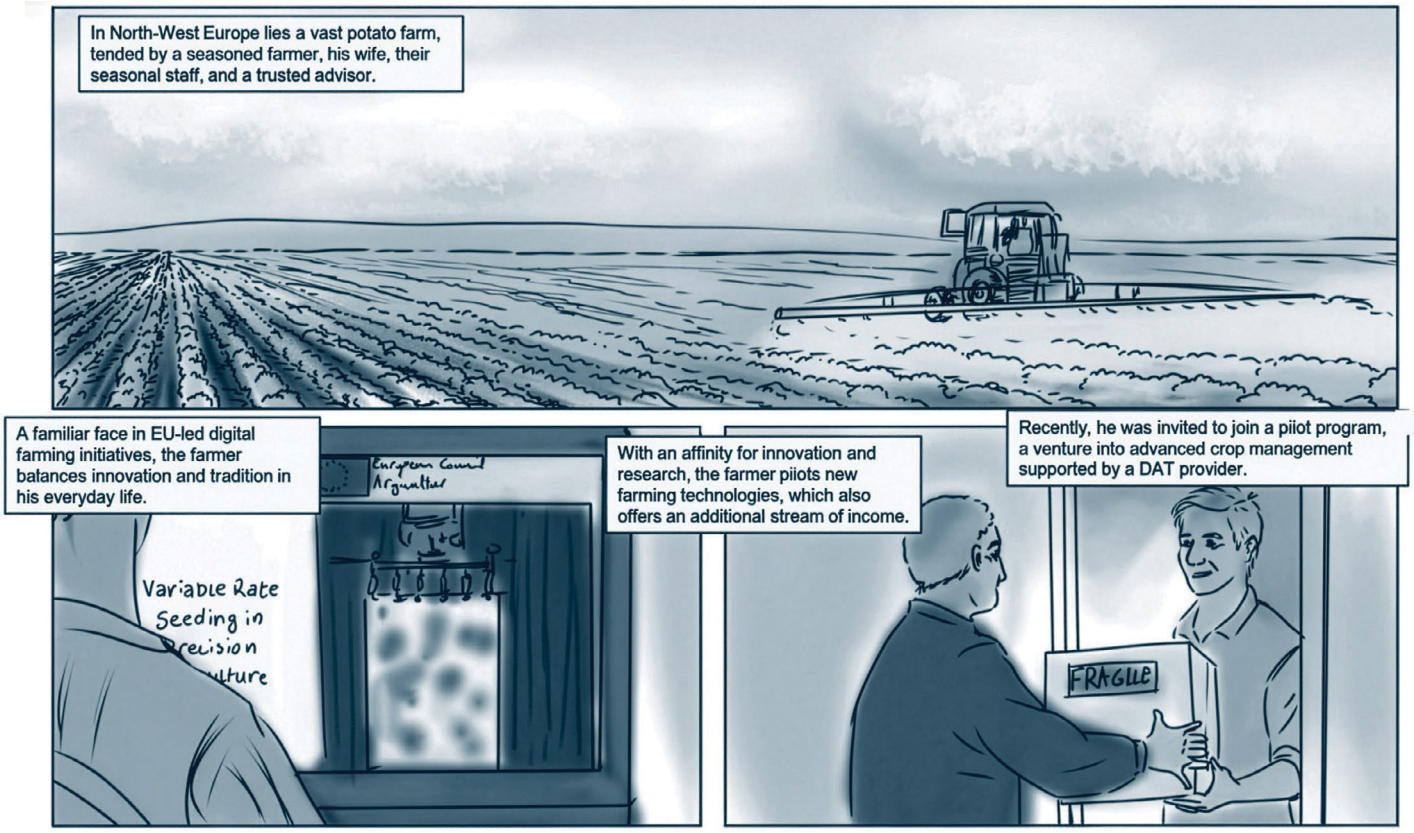


Securing the legacy through digitalisation



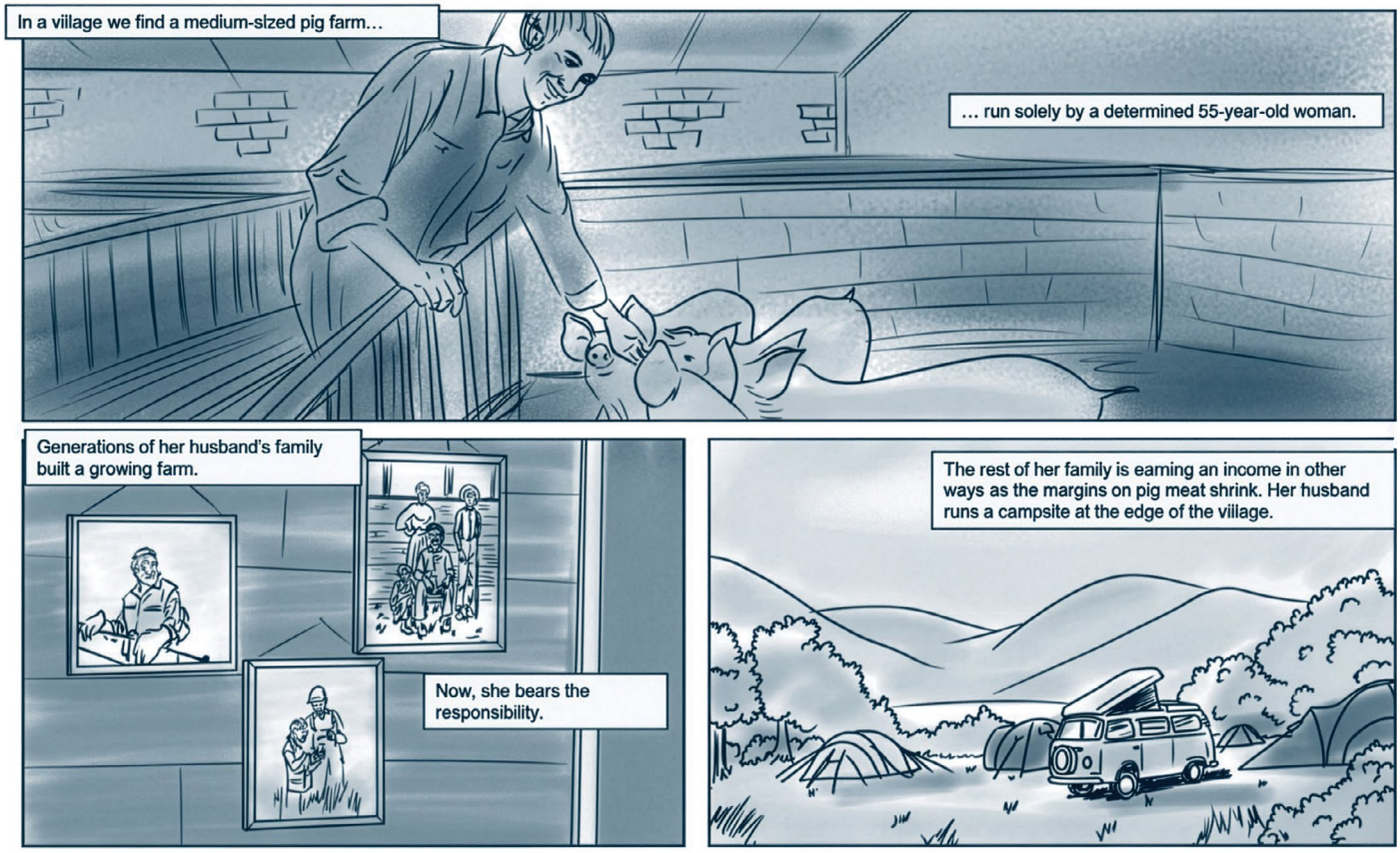


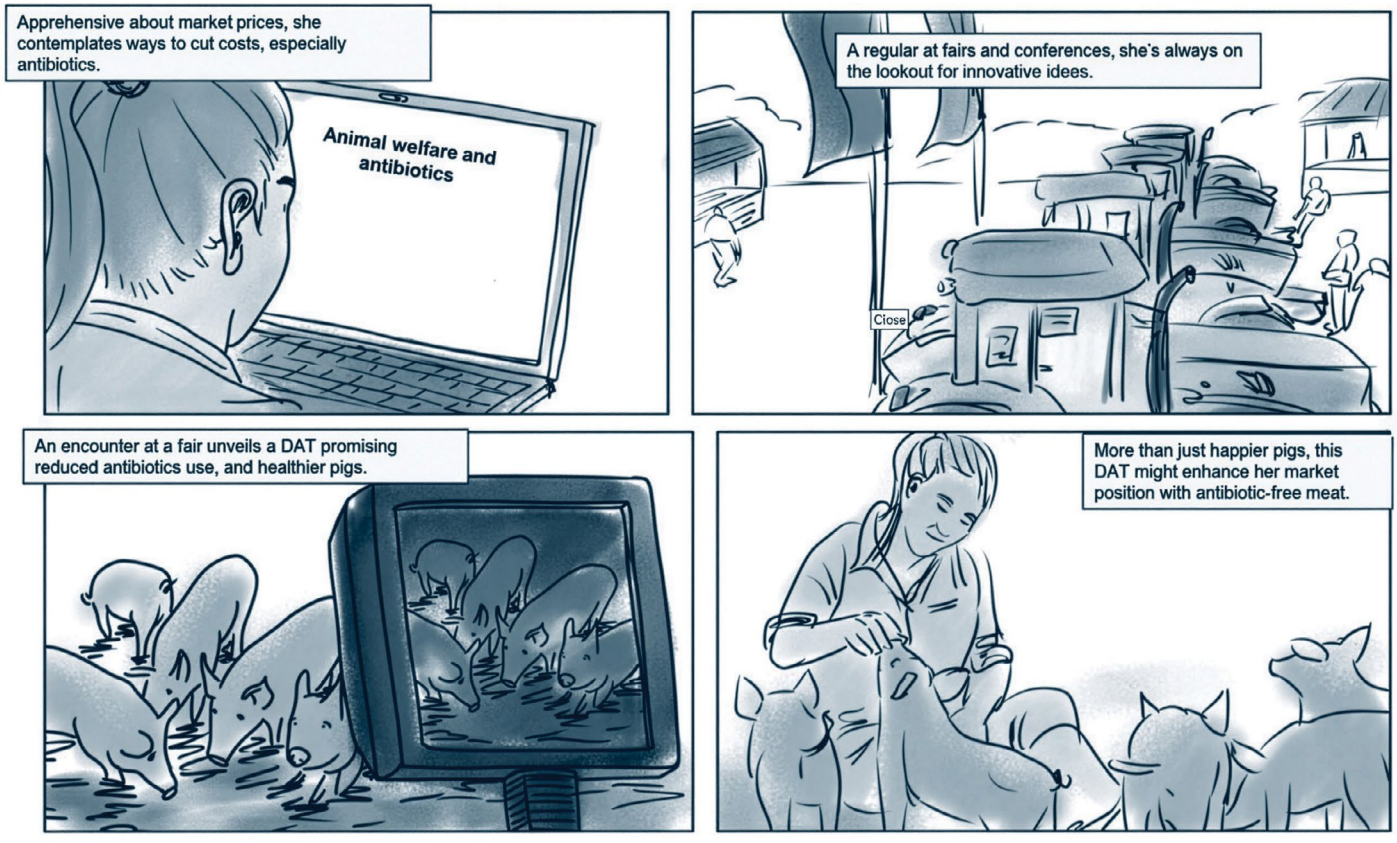
DIGITAL AUTONOMY



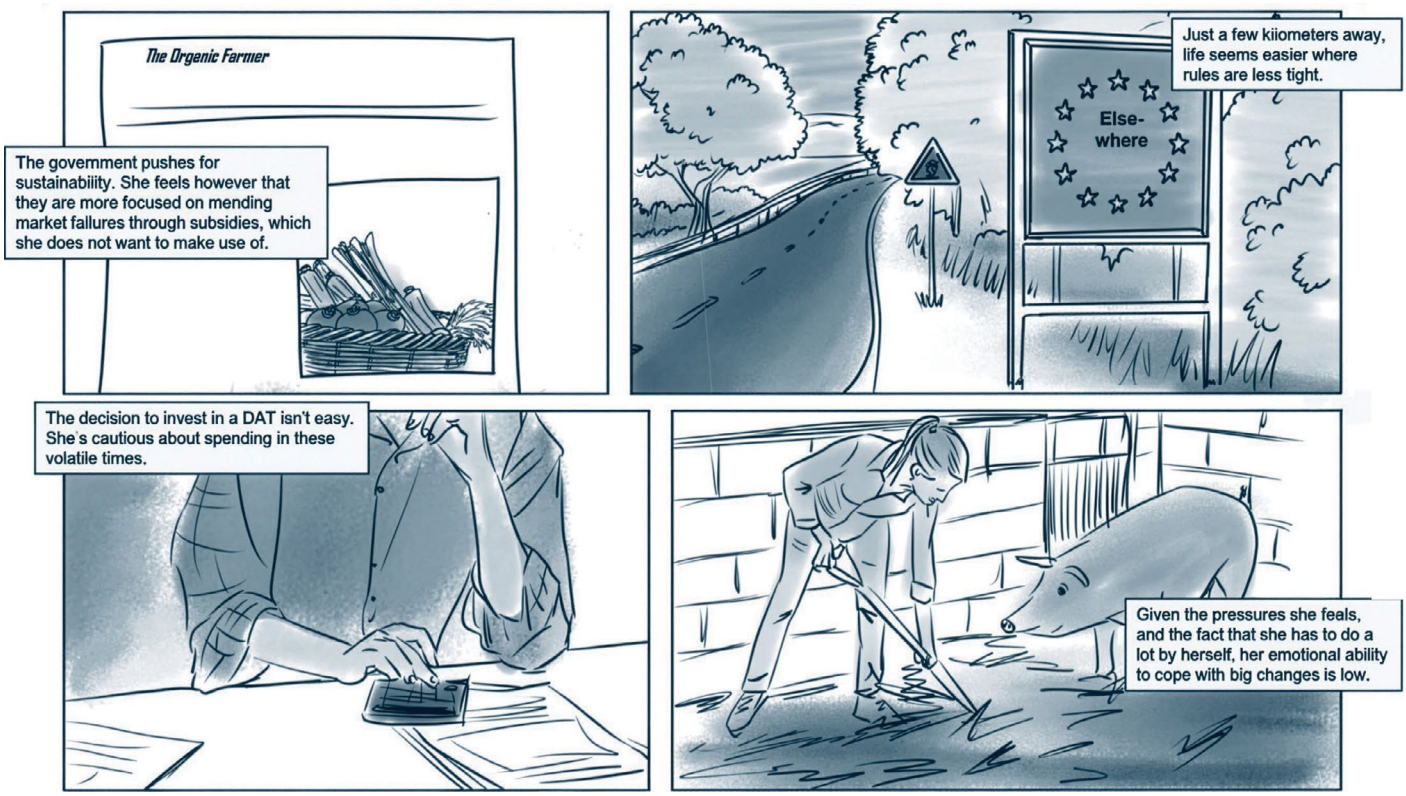

He wonders about the fate of the data his farm produces.
And what if the decision support falls? Where would he stand then?
SYSTEM FAILURE
Could this make him too dependent on a specific DAT supplier?
Unfortunately, his trusted advisor is unable to clear his doubts.
His wife, his equal in all decisions, agrees. They need clarity before committing to such an investment.

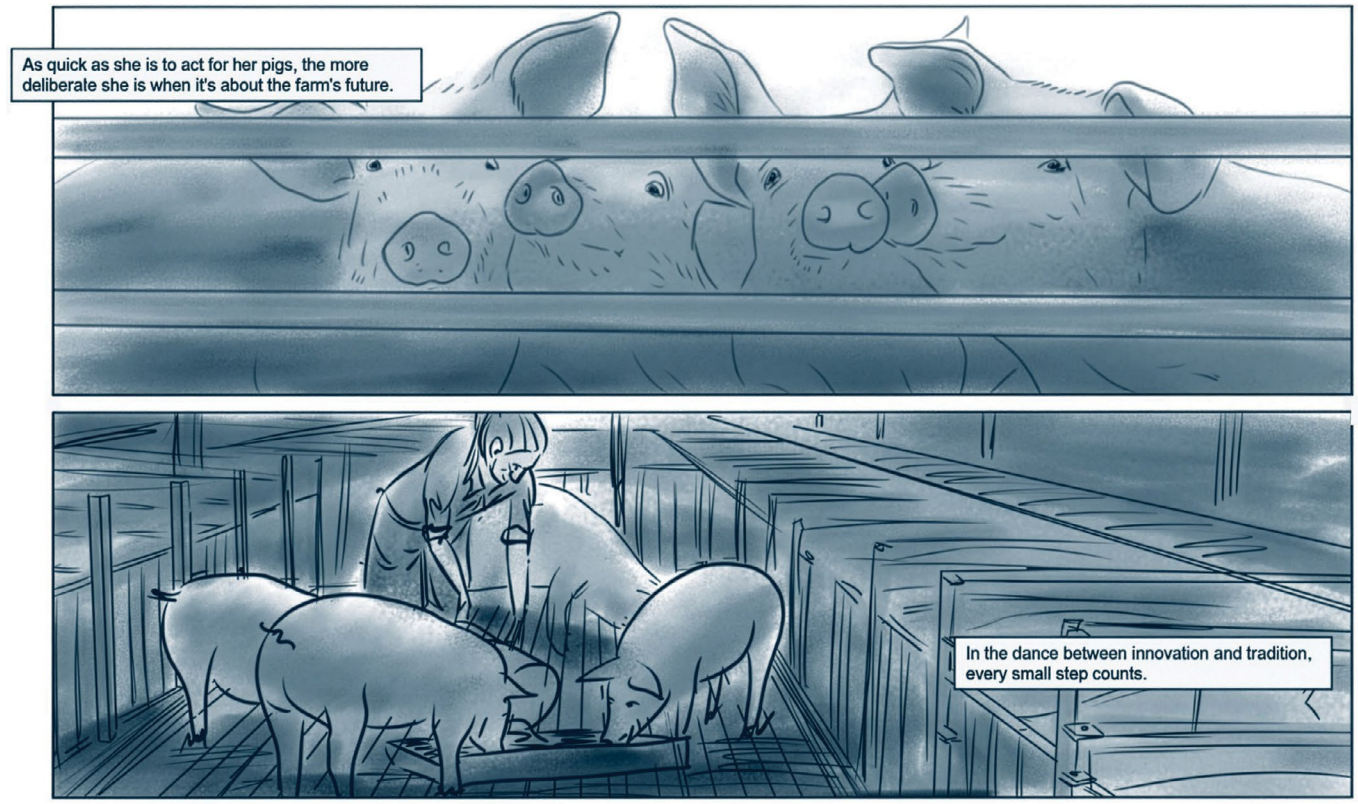
ARDENT AND PRUDENT PIG FARMER



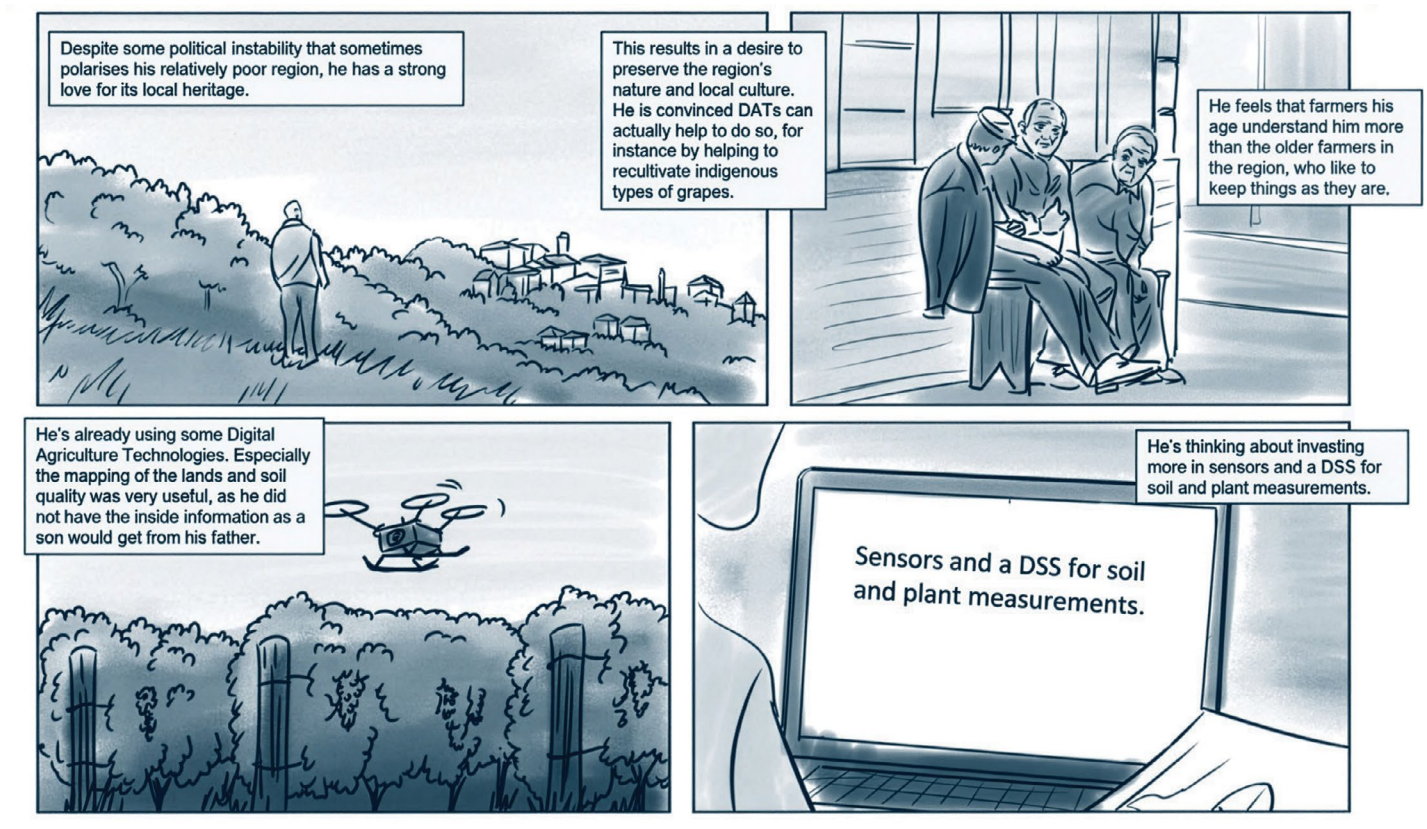


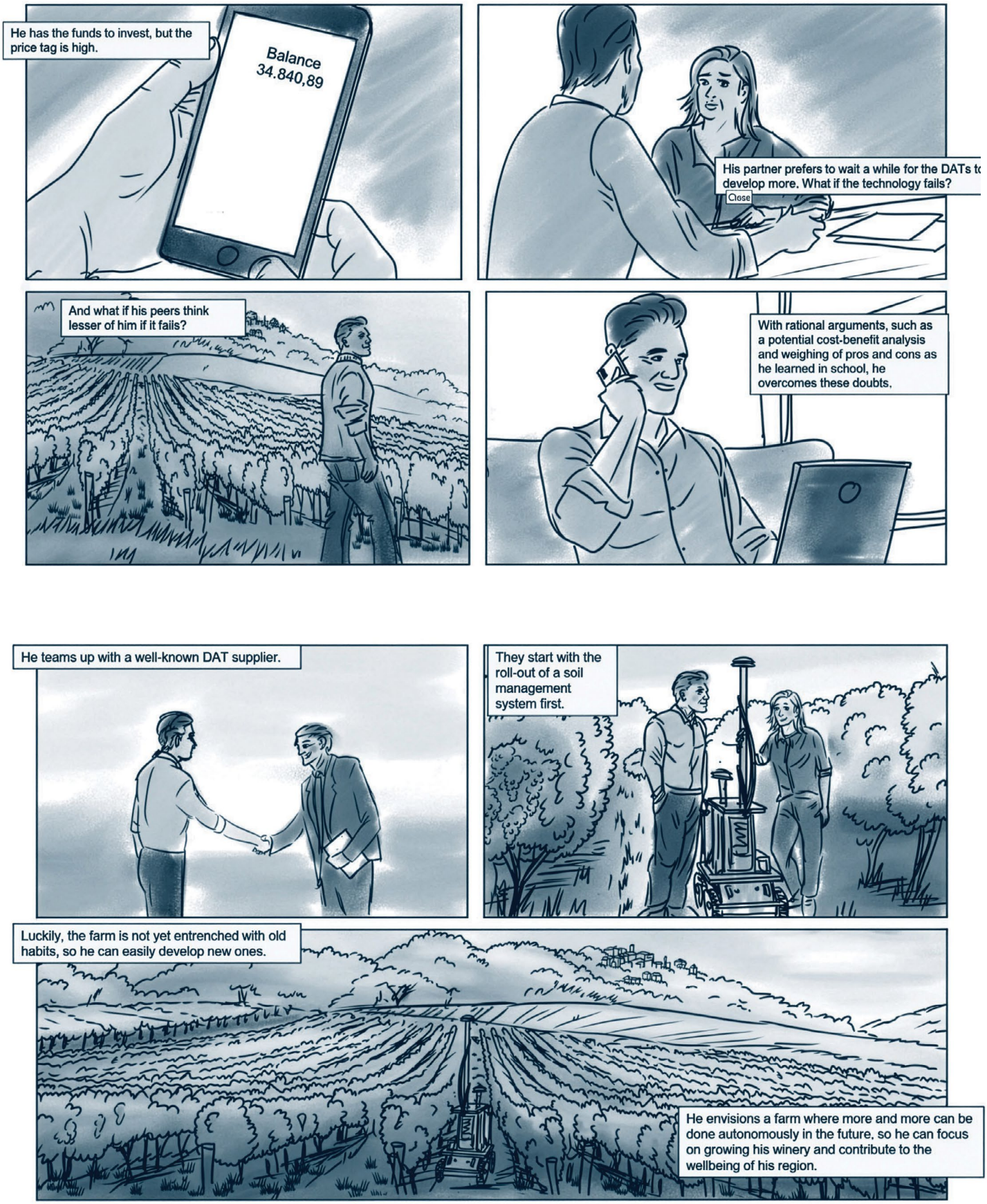
Ardent and prudent pig farmer



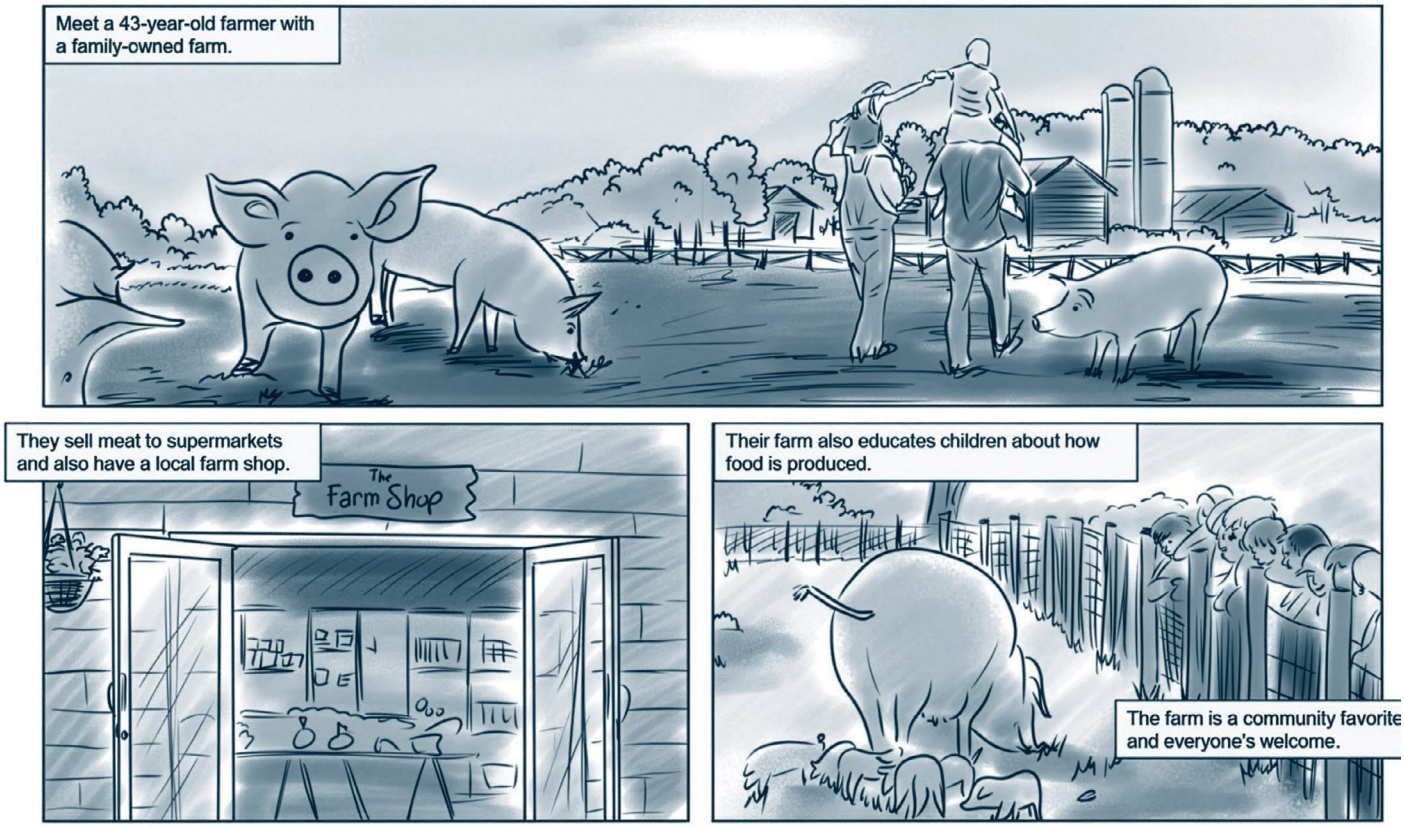


BUSINESS MENTALITY




He has the funds to invest, but the price tag is high.
Balance
34.840,89
His partner prefers to wait a while for the DATs to develop more. What if the technology fails?
Close
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



Non-adopter in doubt

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.

BARRIERS TO DIGITAL ADOPTION

FINANCIAL AND POLITICAL UNCERTAINTY

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

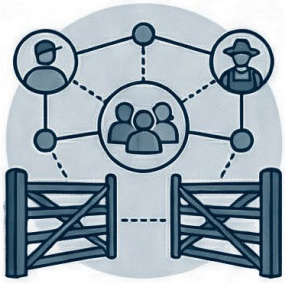
TECHNICAL SPECS VS. REGIONAL CONTEXT

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.

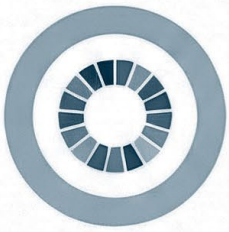
Implement Trial-Phase Risk Sharing

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).

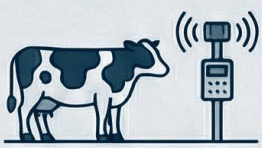
CAP Objectives

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

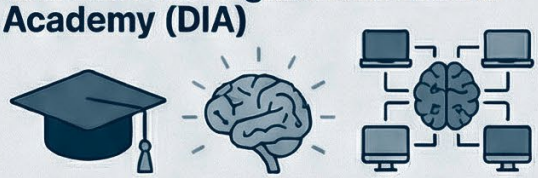
Farmers adopt tools when they see trusted advisors using digital outputs in routine consultations.

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.

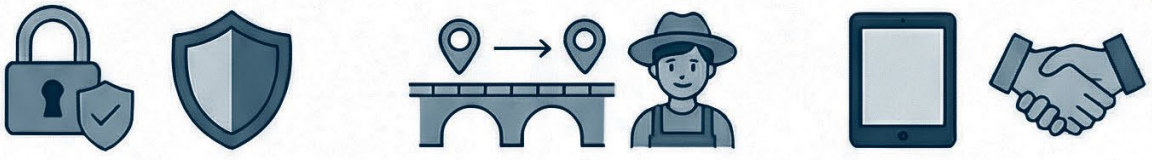
Empower Independent Advisory Services

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.

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.

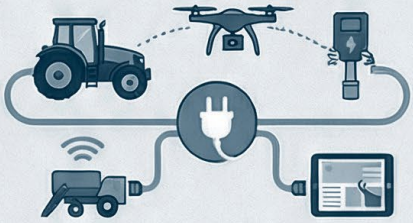
The digital environment shifts focus of farmers from land to desks.

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

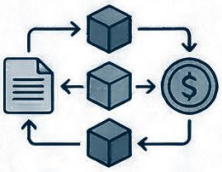
THE AUTONOMY GAP

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

COMPLEX REGULATORY FEAR

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

ECONOMIC VALORISATION



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

STRATEGIC POLICY RECOMMENDATIONS

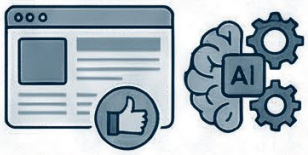
TRANSPARENT COMMUNICATION

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

RELIABLE ADVICE & "FARMINARS"

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

FARMER-CENTRIC TECH DESIGN



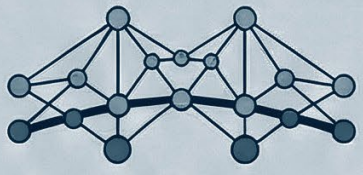
Ensure providers use transparent contract terms and explainable AI interfaces to build trust.

EVIDENCE FROM THE FIELD

ROMANIA: HISTORICAL DISTRUST

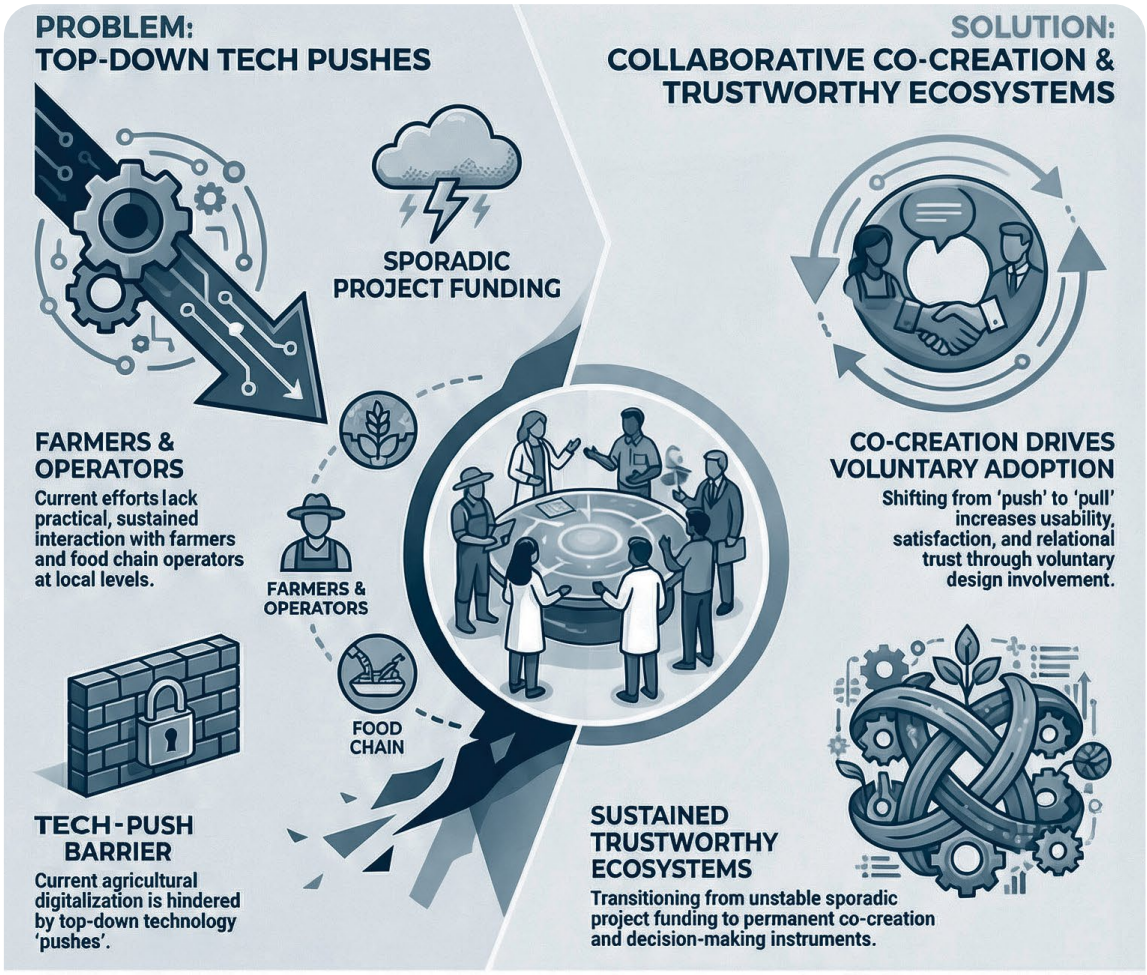
Resistance in test cases #10, #17, and #28 was linked to historical socialist-era distrust of authorities.

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 fermers 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) addoption requires addressing systemic barriers -like infastracture and gender inequity-through risk-sharing accross 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 woman in rural and agricultural sectors. It emphasizes moving beyond simple technology adoption to investigate nuanced social and cultutal 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, cuch as women-only entrepreneurship support, with the mainstreaming of gender equality across all rural and agricultural policies.

Strengthen Gender-Disaggregated Data

Revice data systems like Euroetet to accurately track form ownershiy, 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 (AKNS) to support their contributions to sustainability.

Challenge Stereotypes with Role Models

Disseminate success stories and guides of women-fed 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 subsidics and integrate these findings into the design and monitoring of all interventions.

Apply Human Rights Impact Assessments

Use rights-based indicators to ensure that apricultural policies actively redrexs 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 thon 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 Entrepre-neurship in Agritech

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

5. Make Rural Areas Attractive for Young Women

Address Structural Access to Resources

Focus policy measures on removing abstacles to fand 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 vialde 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, enviromental 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-cented 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

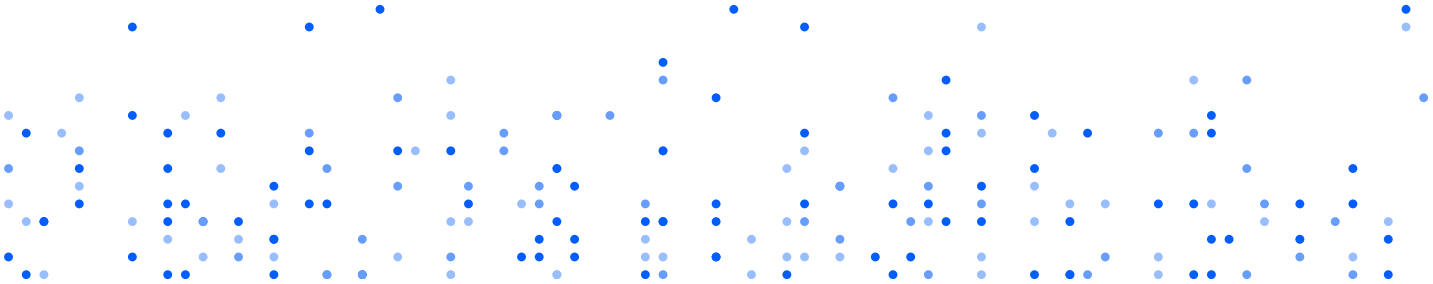
A unified strategy is needed to equip farmers, advisors, and rural professionals with the skills required to manage data-driven farming systems.

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.

QuantiFarm

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



COORDINATOR

gaia EPICHEIREIN

PARTNERS

TNO innovation for life
POLITECNICO MILANO 1863
NEUROPUBLIC
consulai
Confagricoltura
reframe.food
PETERSON
Luke
Confagricoltura
OKYS
copa cogeca
CEMA European Agricultural Machinery
cagasc
Junta de Castilla y León
HORT@
KU LEUVEN
Delphy
INSTITUT DE L'ELEVAGE idele
AUGMENTA
anamob
BETAVIA
AgroSmart
BENCO|Baltic
Farm Frites Poland Dwa
agromais
TERRA LITTERA
ANYSOLUTION
φιλαγροτική
agridea
FLOX

GET IN TOUCH

quantifarm.eu

quantifarmtoolkit.eu

info@quantifarm.eu

Funded by the European Union

Digital Innovation Academy

PUBLISHING NOTES

Contact
Alkis Kyriakou, Project Manager @ reframe.food
(+30) 6948750886 I akyriakou@reframe.food

Editing Team
Alkis Kyriakou, Dimitra Fourkalidou
reframe.food

Coordinations of the QuantiFarm Project
Dionysios Solomos
GAIA Epicheirein

Graphic Design
reframe.food design team

Credits for infographics & designs storyboards

Thessaloniki, March 2025

QuantiFarm