SQAT

SOIL QUALITY ANALYSIS TOOL

Deliverable 4.1

Data management plan

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The author of this document has taken any available measure to ensure that the information contained in this document is accurate, consistent, lawful, and up to date.

Executive Summary

Farms are at the forefront of the data economy, propelled by digitalisation, robotics, and smart algorithms. However, these advancements exacerbate societal pressures on soil health, demanding cleaner water, healthier soils, increased carbon storage and biodiversity. Current solutions are costly and unsuitable for farmers. With this in mind, the EU-funded SQAT project will develop a smart soil mapping service. Combining multi-level, multi-technology approaches, SQAT offers high-resolution soil property maps and tailored solutions for farmers. Using autonomous robot-mounted sensors and innovative in situ analysis tools, the SQAT system enhances productivity while reducing costs. Co-developing with SMEs, SQAT aims to commercialise its solutions, empowering farmers with variable-rate applications for liming, fertilisation, seeding, tillage, and carbon farming.

This document provides an overview of the SQAT project's Data Management Plan (DMP), guided by the European Commission's principles on FAIR Data Management within Horizon 2020. The document outlines how project-related data will be collected, processed, and/or generated by consortium partners, ensuring that this data is rendered Findable, Accessible, Interoperable, and Reusable (FAIR) throughout SQAT's lifecycle and beyond.

Drawing from inputs received by month 8 of the project (October 2024) from all Work Package (WP) Leaders, The discussion demonstrates the practical implementation of FAIR principles within the SQAT DMP, including their integration with the SQAT platform. The SQAT platform encompasses all tools, services, and stakeholders involved in mapping and improving soil health, enabling:

(i) farmers to apply variable-rate techniques for liming, fertilisation, seeding and carbon farming,

(ii) environmental organisations to track and promote soil carbon capture, and

(iii) technology providers to develop and commercialise innovative soil analysis tools.

Analysis of the inputs from relevant WP Leaders indicates significant progress in data management, considering the project's early stage. Specifically, data collected and generated is categorised primarily into data for communication and dissemination purposes, which may include personal data, and data related to soil properties and environmental conditions relevant to pilot studies. The management of open-source datasets, such as those from the Copernicus program, will be further explored in subsequent phases. Given the focus on non-personal data, measures for personal data protection are relatively limited at this stage. The purpose and use of data are generally well-defined, with data exploitation, curation, and preservation aspects expected to be clarified as the project progresses.

The original inputs provided by WP Leaders in response to the initial request for data management plans are included in the appendices. This document is intended to be a living document throughout the duration of the SQAT project. Any updates to specific content, particularly regarding the SQAT platform, will be reflected in subsequent deliverables, including periodic project reports.

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Abbreviations

BSI	Bare Soil Index
D4.1	Deliverable 4.1
DMP	Data Management Plan
EO	Earth Observation
FAIR	Findable, Accessible, Interoperable, and Reusable
IP	Intellectual Property
K	Potassium
N	Nitrogen
P	Phosphorus
SatNav	Satellite Navigation
SOC	Soil Organic Carbon
SQAT	Soil Quality Analysis Tool
VI	Vegetation Index
WP	Work Package

1 Introduction

1.1 Project Overview

SQAT is designed to support the new paradigm in agriculture: the regenerative farm. In a regenerative farming system, soil capital is preserved and even enhanced, which is the cornerstone of environmental sustainability in EU farming. This aligns with key EU policies, including the Farm to Fork Strategy, the Biodiversity Strategy for 2030, the upcoming Soil Strategy for 2030, and the new Common Agricultural Policy for 2023-2027, all aimed at implementing the European Green Deal.

Traditionally, agricultural fields have been managed as homogeneous entities despite the inherent variability in soil properties within these fields. Mapping soil properties has historically been an expensive and labour-intensive process, limiting farmers' ability to leverage this information. However, advancements in digitalisation, robotisation of farm machinery, data management, processing, and sensing techniques have made it feasible and actionable to measure soil property variability.

SQAT serves as an intervention for partners to accelerate their service concepts into the market by deploying space-based data sources, including Earth Observation (EO) and Satellite Navigation (SatNav). By integrating these with cutting-edge in-field proximal sensor-based measurement technology, SQAT makes the measurement of soil properties accessible and affordable for many farmers. The resulting soil property maps offer direct actionable insights to improve soil quality, maintain ecosystem functions such as water retention and habitat restoration, enhance food production and mitigate negative agricultural externalities like emissions, eutrophication and loss of biodiversity.

In the SQAT project, we develop autonomous soil sampling equipment for the smart farmer and data-driven advisor. With the tipping point in precision agriculture adoption surpassed, the demand for high-quality, actionable soil data has never been greater. Our project capitalises on Europe’s investments in space technology and data innovations to meet this demand.

The overall objective of SQAT is to improve the precision, quality, and affordability of soil data, addressing the significant bottleneck in the agricultural data economy. To achieve this, the project aims to develop and commercialise a Copernicus-driven, automated, sensor-based system for high-resolution soil mapping, enabling new and improved Smart Farming Applications.

1.2 Purpose of the Document

The purpose of the DMP is to outline the comprehensive strategy for managing all data-related activities within the SQAT project. This document serves as a guide to ensure that data generated, collected and processed by the project is managed in accordance with the FAIR principles as endorsed by the European Commission under the Horizon 2020 framework.

Specifically, this DMP details the protocols for data collection, processing, storage, sharing and preservation across the project's lifecycle. It also addresses the roles and responsibilities of consortium partners regarding data stewardship, ensuring that all data management practices align with legal, ethical and regulatory requirements, including GDPR compliance where applicable.

By establishing a clear framework for data governance, this DMP aims to facilitate the effective and secure use of data, supporting the overall objectives of the SQAT project. It provides guidelines for maintaining data quality, security, and integrity while promoting transparency and accountability in data handling practices. This document will be regularly updated to reflect any changes in the project's scope or in response to emerging data management challenges, ensuring that it remains a relevant and dynamic resource throughout the duration of the project.

1.3 Document Scope

The SQAT DMP focuses on the complete data management lifecycle for all data to be collected, processed, and/or generated by the project. This document captures the data management strategies per WP, as available by Month 8 of the project. It addresses the following key aspects:

- **Types of Data:** What data will be collected, processed, or generated throughout the project.
- **Methodologies and Standards:** The methodologies and standards that will be applied to ensure data quality and compliance.
- **Data Accessibility:** Whether the data will be open or confidential, and the measures in place to protect sensitive information.
- **Alignment with Project Objectives:** How the data collected will contribute to achieving the overall objectives of the SQAT project.

Additionally, this DMP outlines how data will be curated and preserved, including provisions for post-project data preservation. These aspects, along with the rest of the content covered by this DMP, illustrate how the project will make data findable, accessible, interoperable and reusable in practice, in accordance with the FAIR principles outlined by the European Commission.

In line with the European Commission's Guidelines, the DMP for the SQAT project exclusively covers research data. As defined, "Digital research data is information in digital form (particularly facts or numbers), collected to be examined and used as a basis for reasoning, discussion, or calculation." This includes, but is not limited to, statistics, experimental results, measurements, fieldwork observations, survey results, interview recordings, and images. The definition is broad, allowing for various types of information to be considered research data.

This deliverable integrates inputs from nearly all WP Leaders, providing an overview of the respective data management plans. Specifically, it includes contributions from WP1-Manage, WP2-Integrate, WP3-Enable, WP5-Promote, and WP6-Launch.

The creation of this DMP falls under Deliverable 4.1 (D4.1) Data Management Plan, reflecting the objectives of WP4, particularly concerning the assurance of project goals and contractual obligations. This document is intended to be a living document throughout the duration of the SQAT project; any updates to specific content, particularly regarding the SQAT platform, will be provided in subsequent deliverables.

1.4 Methodology

This deliverable is based on input received from WP Leaders, which was further processed for the purpose of this analysis. The input request was structured around the five main elements outlined in the task description, addressing the following:

- **Data Collection and Generation:** WP Leaders were asked to provide details regarding each dataset, including the dataset name, data types, expected size, origin, and how the data aligns with the project's objectives.
- **Responsible Parties and Intellectual Property (IP):** WP Leaders were requested to clarify whether the datasets identified would be open or confidential, ensuring that IP considerations were explicitly addressed.
- **Data Exploitation and Reuse:** WP Leaders were similarly requested to identify data formats, standards, and metadata, as well as to specify any planned reuse of existing data, ensuring consistency and interoperability within the project.
- **Data Curation and Preservation:** WP Leaders provided information regarding the usefulness and accessibility of the data, as well as how the data would contribute to the project's objectives. This also included plans for long-term data preservation, ensuring that valuable data remains accessible beyond the project's duration.
- **Privacy Protection:** Although personal data protection is less central to the scope of the SQAT project, WP Leaders were asked to detail the technical and organisational measures in place to safeguard privacy where relevant.

In the context of this analysis, the discussion closely follows the original inputs provided by the WP Leaders. Extensive rewording was avoided to maintain the precision and accuracy of the information, ensuring that the deliverable accurately reflects the contributions of the WP Leaders without introducing any unintended interpretations.

1.5 Target Audience

This document, as a public deliverable, is not only intended for the SQAT consortium and European Commission services, but will also be made available to the wider public through the project's website. As such, this DMP is targeted towards a broad audience, including farmers, agricultural technology providers, environmental organisations, policymakers and all stakeholders interested in advancing soil health and sustainable farming practices. Additionally, it is aimed at those engaged in supporting climate change mitigation efforts through improved soil management and carbon farming initiatives.

1.6 Structure

There will be four (4) sections present in this document. Following the current introductory section 1, section 2 provides for a summary of the data management plans received by SQAT WP Leaders. Section 3 provides for an analysis of the resulting findings in line with the objectives of a DMP. Finally, Section 4 draws a set of concluding remarks. The original input provided by WP Leaders, as well as the original request circulated by D4.1 leading partner can be found under the Appendices.

2 Data Summary

2.1 Input tables

This section summarises the inputs delivered by the SQAT WP leaders in the questionnaire distributed in month four (04) of the project. It touches upon the type, origin, format and size of data, as well as the purposes of data collection, accessibility and privacy measures to the extent relevant. Furthermore, it sets out how the data management is related to the SQAT project objectives. It is important to note, this summary may be subject to further updates during the project.

Name	**Srđan Pavlović, Igor Milosavljević & Sara Matković**			
Partner	**The Association of Balkan Eco-Innovations (ABE)**			
WP	**WP1**	**WP5**		
New/Existing Dataset	New	New	New	New
Status	-	-	-	-
Dataset Name	Contact list SQAT	Dissemination tracker	Ambassador list	Travel sheet
Data Type	text	text	text	text
Data Format	xlsx	xlsx	xlsx	xlsx
Format of Collection	Digital	Digital	Digital	Digital
Expected Size	1-100	1-100	1-100	1-100
Data Capture Frequency	Adhoc.	Adhoc.	Adhoc.	Adhoc.
Data Temporality	Real-time	Real-time	Real-time	Real-time
Data Origin	Manual Entry	Manual Entry	Manual Entry	Manual Entry
Data Location	European Union	European Union	European Union	European Union
Data License	-	-	-	-
Data Access	Internal access	Internal access	Internal access	Internal access
Data Sensitivity	Personal Identifiable Information	Personal Identifiable Information	Personal Identifiable Information	Personal Identifiable Information
Data Retention	3.5 years	3.5 years	3.5 years	3.5 years

Name	Axel Wilkensens	Dušan Jovanović							
Partner	ILVO	Terra Controlling TMD							
WP	WP2								
New/Existing Dataset	New	New	New	New	New	Existing	Existing	Existing	Existing
Status	-	-	-	-	-	Ongoing	Ongoing	Ongoing	Ongoing
Dataset Name	Robot Sensor	Farm Boundary	Raster zones base on satellite images VI and BSI	Basic chemical analysis of the soil (pH, NPK) and microelements in the soil	Maps created on the results of soil analysis	Farm Boundary	Raster zones base on satellite images VI and BSI	Basic chemical analysis of the soil (pH, NPK) and microelements in the soil	Maps created on the results of soil analysis
Data Type	Numerical, Text & Spatial	Spatial	Raster	Numerical and Text	Spatial	Spatial	Raster	Numerical and Text	Spatial
Data Format	CSV	shp	tiff	XLSX and PDF	Raster and vector	shp	tiff	XLSX and PDF	Raster and vector
Format of Collection	Digital	Digital	Digital	paper form and Digital entry	Digital	Digital	Digital	paper form and Digital entry	Digital
Expected Size	10000+	1001-10000 entries	10000+	1001-10000	10000+	1001-10000 entries	10000+	1001-10000	10000+
Data Capture Frequency	Per site visit	Multi-annual	Multi-annual	Monthly	Multi-annual	Multi-annual	Multi-annual	Monthly	Multi-annual
Data Temporality	Periodic	Periodic	Periodic and historical	Periodic	Periodic	Periodic	Periodic and historical	Periodic	Periodic
Data Origin	Sensor platform automatic entry	Manual entry	Internal systems or External source or Manual entry	Ordinary manual entry sometimes and external source	Internal systems or Manual entry	Manual entry	Internal systems or External source or Manual entry	Ordinary manual entry sometimes and external source	Internal systems or Manual entry
Data Location	European Union	European Union	European Union	European Union	European Union	European Union	European Union	European Union	European Union
Data License	Proprietary License	Creative Commons	Proprietary License	Proprietary Licenses	Proprietary License	Creative Commons	Proprietary License	Proprietary Licenses	Proprietary License
Data Access	Internal Access	Internal access	Internal/Customer access	Internal/Customer access	Internal/Customer access	Internal access	Internal/Customer access	Internal/Customer access	Internal/Customer access
Data Sensitivity	Regulatory Compliance	Sensitive personal information	Personal Identifiable Information	Regulatory Compliance	Personal Identifiable Information	Sensitive personal information	Personal Identifiable Information	Regulatory Compliance	Personal Identifiable Information
Data Retention	No limit	5 years	5 years	5 years	5 years	5 years	5 years	5 year	5 years

Name	Sebastian Vogel					
Partner	ATB					
WP	WP3					
New/Existing Dataset	New	New	New	New	Existing	Existing
Status	-	-	-	-	Ongoing	Ongoing
Dataset Name	Field boundaries	Near infra-red spectra	Lab-on-the-field data (pH, P, K, Mg)	Lab reference data for soil texture and soil organic matter	Satellite images	Elevation data
Data Type	spatial	numerical	numerical	Numerical	Spatial (raster)	Spatial (raster)
Data Format	.shp	CSV	CSV	CSV	GeoTIFF	GeoTIFF
Format of Collection	Digital	In-field capture	In-field capture	Digital	Remote sensing	Remote sensing
Expected Size	1001-10000 entries	10000+ entries	10000+ entries	1001-10000 entires	10000+ entries	10000+ entries
Data Capture Frequency	Once	Annual	Annual	Annual	Once	Once
Data Temporality	Historical	Real-time	Real-time	Periodic	Historical	Historical
Data Origin	Manual entry	Internal systems	Internal systems	External source	External source	External source
Data Location	Germany	Germany	Germany	Germany	Germany	Germany
Data License	Creative Commons	Proprietary Licenses	Proprietary Licenses	Proprietary Licenses	Public Domain	Public Domain
Data Access	Internal	Internal	Internal	Internal	Public access	Public access
Data Sensitivity	Sensitive personal information	-	-	Sensitive personal information	-	-
Data Retention	5 years	5 years	5 year	5 years	-	-

Name	Tamme van der Wal				
Partner	AeroVision				
WP	WP6				
New/Existing Dataset	New	New	Existing	Existing	Existing
Status	-	-	Ongoing	Ongoing	Ongoing
Dataset Name	Soil zone map	Point soil samping lab analysis results	Bare soil satellite imagery Sentinel-2	Bare soil satellite imagery Planet-Superdove	Digital terrain map
Data Type	Spatial (timestamped)	Numerical (location and time-based)	Spatial (timestamped)	Spatial (timestamped)	Spatial (timestamped)
Data Format	GeoTIFF	xlsx or csv	GeoTIFF	GeoTIFF	GeoTIFF
Format of Collection	Digital	Digital	Digital	Digital	Digital
Expected Size	1011-10000	10000+	1011-10000	1011-10000	1011-10000
Data Capture Frequency	Annual	Annual	Annual	Annual	Once
Data Temporality	Periodic	Periodic	Historical	Historical	Historical
Data Origin	Internal systems	External source	External source	External source	External source
Data Location	European Union	European Union	European Union	European Union	European Union
Data License	Proprietary License	Proprietary License	Open data commons	Proprietary License	Open data commons
Data Access	Internal/Customer access	Internal/Customer access	Internal access	Internal access	Internal access
Data Sensitivity	-	-	-	-	-
Data Retention	5 Years	5 Years	5 Years	5 Years	n/a

3 Analysis of the data management plans

3.1 Data collected and generated

3.1.1 WP1 - Manage: Project management & coordination

WP1 is dedicated to overseeing effective project management and ensuring smooth coordination across the consortium. This work package encompasses various critical activities, including coordination, administration and financial management, all aimed at maintaining the project's progress and coherence.

Key responsibilities under WP1 include the establishment and facilitation of the External Advisory Board, which provides strategic guidance and expertise to support the project's objectives. Additionally, WP1 is responsible for quality assurance and risk management, ensuring that project outputs meet high standards and that potential risks are identified and mitigated effectively.

The following type of data is integral to the operations of WP1:

- **Contact List**: This data set includes information on consortium members, advisory board members and other key stakeholders. It is essential for effective communication, coordination and management of project activities.

3.1.2 WP2 - Integrate: System integration & co-creation

WP2 focuses on the integration and co-creation of the key technological components of the SQAT System. This includes the EO algorithms, navigation protocols, sensors and robotic platforms, which comprise both the mechanical and electronic elements necessary for the effective deployment of sensors in the field. The work package also encompasses the planning, implementation and management of all use cases, where the system is tested in real-world operational contexts, such as arable and horticultural fields.

The activities under WP2 are crucial for validating the functionality and effectiveness of the SQAT System across various agricultural environments. The use cases are meticulously managed and implemented to ensure the system performs optimally under diverse conditions. Additionally, EO data is utilised for field stratification and identification, a vital process for customising agricultural interventions to the specific characteristics of each zone, thereby enhancing the precision and efficiency of farming practices.

The following types of data are integral to the operations of WP2:

- **Farm Boundary Data**: Vector geospatial data outlining the boundaries of agricultural fields involved in the use cases, provided by farmers. This data is crucial for accurate field mapping and stratification, enabling targeted interventions.
- **Raster Zones Data**: Generated from satellite imagery, these raster data sets are based on Vegetation Index (VI) and Bare Soil Index (BSI). They delineate different zones within each field, providing essential information for variable-rate applications, which optimise input use and improve crop yields.
- **Chemical Analysis Data**: Data collected from soil samples, including basic chemical analysis of pH, nitrogen (N), phosphorus (P), potassium (K) and other microelements. This information guides the

application of soil amendments such as fertilisers and lime, ensuring their effective use to enhance soil health.

- **Soil Analysis Maps**: Maps created based on the results of soil chemical analysis. These maps are used to guide precision agriculture practices, enabling targeted interventions that improve soil fertility and crop productivity.

3.1.3 WP3 - Enable: Data integration & smart farming applications

Focusing on integrating the key technological components of the SQAT System, this WP manages and implements various use cases in real-world operational contexts. WP3 involves the co-creation and deployment of essential system elements, including EO algorithms, navigation protocols, sensors and robotic platforms, encompassing both the mechanical and electronic components necessary for effective field deployment.

The scope of activities includes the planning, implementation and management of use cases designed to test the SQAT System under operational conditions. These use cases are essential for validating the system's functionality and effectiveness across diverse agricultural environments. Additionally, EO data is employed for field stratification and identification, a critical process for tailoring agricultural interventions to the specific conditions of each zone, thereby enhancing the precision and efficiency of farming practices.

The following types of data are integral to the operations of WP3:

- **Farm Boundary Data**: Vector geospatial data provided by farmers, outlining the boundaries of agricultural fields involved in the use cases. This data is essential for accurate mapping and field stratification, supporting targeted interventions.
- **Near Infra-Red Spectra**: Collected data using sensors, crucial for analysing various soil properties in the field, which informs decisions on soil management practices.
- **Lab-on-the-Field Chemical Analysis**: Conducted on-the-go in the field, this data includes on-site chemical analysis of soil, providing immediate insights into soil health.
- **Lab Reference Data for Soil Texture and Soil Organic Matter**: Data collected in controlled environments, serving as a reference to validate and calibrate in-field measurements of soil texture and organic matter content.
- **Satellite Imagery**: Utilised to generate raster data that delineates different zones within each field, this imagery supports the implementation of variable-rate applications, enhancing input efficiency and crop yields.
- **Elevation Data**: Used in conjunction with other data sets to understand field topography, which influences water movement, soil erosion, and overall crop health.

3.1.4 WP5 - Promote: Engagement, communication & dissemination

WP5 focuses on planning and implementing activities that drive communication, engagement, and dissemination of the SQAT project's results. This work package is dedicated to raising awareness about the project, ensuring that key stakeholders are informed and involved, and effectively communicating the project's progress and outcomes to a wider audience.

The scope of WP5 includes the development of a comprehensive communication, dissemination, and exploitation plan. This involves strategic communication and marketing efforts to reach and engage with targeted audiences, as well as ensuring the active involvement of key stakeholders throughout the

project's duration. Additionally, WP5 is responsible for the dissemination of project results and contributions to policy discussions, ensuring that the findings and innovations from the SQAT project are shared and leveraged within relevant policy frameworks.

The following type of data is integral to the operations of WP5:

- **Dissemination Tracker**: A tool used to monitor and document the dissemination activities undertaken throughout the project. This data is crucial for tracking the reach and impact of the communication efforts.
- **Ambassador List**: A database of key individuals and organisations that act as advocates for the project, helping to spread its message and engage with wider audiences. This list is essential for targeted communication and engagement strategies.
- **Travel Sheet**: Records of travel related to the project's communication and dissemination activities. This data helps manage logistics and ensures transparency in the project's outreach efforts.

3.1.5 WP6 - Launch: Business modelling, commercialisation & brokerage

WP6 is dedicated to transferring the results of the SQAT project into viable commercial services and products. This work package encompasses several critical activities, including defining user needs related to soil, soil mapping, and smart farming applications. Additionally, it involves the development of business plans and financial models that will guide the commercialisation process.

The scope of WP6 also includes portfolio management, legal support, and pre-sales brokerage, which are essential for positioning the project's outcomes in the marketplace. Collaborative models are established to ensure the continuity of services beyond the project's duration. Furthermore, the operational setup and service quality assurance processes are defined to maintain high standards in the delivery of these commercial services.

The following types of data are integral to the operations of WP6:

- **Soil Zone Map**: A digital representation of different soil zones within agricultural fields, generated through data analysis and mapping. This map is used to inform decision-making processes for soil management and smart farming applications.
- **Point Soil Sampling Lab Analysis Results**: Data collected from soil samples analysed in laboratories, providing precise information on soil properties, such as nutrient content and organic matter. These results are critical for validating the accuracy of soil zone maps and optimising soil management practices.
- **Bare Soil Satellite Imagery (Sentinel-2)**: High-resolution satellite imagery of bare soil, captured by Sentinel-2, used to assess soil conditions and support the creation of detailed soil maps.
- **Bare Soil Satellite Imagery (Planet-SuperDove)**: Similar to the Sentinel-2 imagery, this data is obtained from the Planet-SuperDove satellite, offering additional insights into soil conditions and aiding in the generation of accurate soil maps.
- **Digital Terrain Map**: A digital representation of the terrain, used to analyse topographical features that may influence soil conditions and agricultural productivity. This map is essential for planning and implementing precision farming strategies.

3.2 Responsible parties and Intellectual Property

This section outlines the responsibilities for data collection within the SQAT project and addresses relevant IP considerations.

For **WP1 – Manage: Project Management & Coordination**, ABE is the responsible partner. The data processed under this work package are to be held confidential, ensuring secure project coordination and management. ABE is also responsible for data management tasks under **WP5 – Promote: Engagement, Communication & Dissemination**, which similarly involves handling confidential information related to communication activities. WP5 handles data related to public engagement and project dissemination. While some data, such as public communications and media materials, are intended for broad dissemination, other data sets, such as stakeholder lists, are confidential and managed accordingly.

WP2 – Integrate: System Integration & Co-Creation is led by ILT with inputs from ILVO and Terra Controlling TMD. The data involved in this work package includes both open-access and confidential information, depending on the data source. For instance, satellite data sets may be publicly available, while other integration-related data sets may be restricted due to commercial or proprietary considerations.

ATB leads **WP3 – Enable: Data Integration & Smart Farming Applications.** The data processed within this work package is crucial for developing and deploying smart farming solutions. While some data sets may be open or shared under specific agreements, others, particularly those involving advanced algorithms or proprietary technologies, are treated as confidential.

WP4 – Govern: Data Management & Governance is under the leadership of FarmEye. This work package is critical for establishing the data governance framework for the SQAT project. The data here is generally confidential, focusing on ensuring compliance with regulatory standards and safeguarding sensitive information.

Finally, **WP6 – Launch: Business Modelling, Commercialisation & Brokerage** is led by AeroVision. This work package involves data that is critical for the commercialisation strategy of the SQAT System. Much of this data is confidential, particularly information related to business models and market strategies, though some elements may be shared with third parties or made publicly available to support market engagement and adoption.

3.3 Data exploitation and reuse

As outlined in the previous section, data exploitation is primarily associated with WP6 – Launch: Business Modelling, Commercialisation & Brokerage, where data is leveraged for commercial purposes. Some data sets under WP2 – Integrate: System Integration & Co-Creation and WP3 – Enable: Data Integration & Smart Farming Applications are also intended for commercial exploitation. Other data sets are held confidential or are open source, depending on their nature and intended use.

For most work packages, except WP2, WP3 and WP6, there is limited reuse of existing data. WP2 – Integrate, WP3 – Enable, and WP6 – Launch reuse existing data for various purposes, including the generation of added-value datasets, field stratification, and optimisation of farming practices. This reuse

is crucial for tasks such as monitoring soil organic carbon (SOC) changes, determining optimal locations for soil sampling, and estimating annual SOC sequestration. Additionally, reused data supports the verification of whether regenerative practices are applied by farmers and aids in running smart farming services.

Regarding standards and metadata, WP4 – Govern and WP6 – Launch have indicated that most data sets adhere to established methodologies relevant to agricultural management, which focuses on improved agricultural land management, as well as other methodologies identified through research. Metadata collection under WP3 – Enable includes data from various sources, including satellite imagery and soil analysis, ensuring comprehensive data integration and usability across SQAT systems.

3.4 Data curation and preservation

All data will be securely stored by partners in line with legal requirements for the required duration of the datasets, as defined by each partner. The data will be deleted after its retention period has been completed. Where relevant, as stated elsewhere in this document, certain non-commercial non-personal data will be shared openly to benefit the larger scientific and development community.

Data generated under the project management and coordination activities is crucial for overseeing the project's financial and administrative aspects. This data is securely stored and remains confidential, accessible only to key personnel responsible for project coordination and financial management.

The data related to system integration and co-creation activities is essential for the ongoing development and refinement of the SQAT System. This information, while primarily used internally, may also have broader implications for the wider agricultural and technological communities, depending on the nature of the data and its potential for external application.

Data integrated and utilised in smart farming applications plays a significant role in advancing the project’s objectives. Some of this data, particularly that which is relevant to precision agriculture and soil health monitoring, may be valuable beyond the immediate scope of the project, offering insights that could benefit the broader agricultural sector. However, much of this data is likely to remain confidential, given its proprietary nature and the competitive advantages it may confer.

The information gathered for data management and governance purposes is instrumental in establishing baseline metrics for environmental impacts, such as carbon footprints, and for calibrating farm data obtained from Earth observation technologies. In the future, this data may be pivotal in the registration of carbon credit projects, providing a valuable tool for farmers seeking to enhance the sustainability of their practices. Data from these activities is also expected to support the measurement of regenerative agricultural practices, offering insights that could be shared with participating farmers to strengthen their efforts.

Additionally, any scientific publications resulting from the SQAT project will be made available in an online repository, ensuring that the knowledge generated is accessible to the broader research community. Further details on data curation, preservation, and dissemination are outlined in the project’s Grant Agreement.

3.5 Privacy protection

The SQAT platform adheres to a comprehensive privacy policy that applies to all users, including visitors and subscribers. This policy is prominently displayed on the project website and is particularly relevant for data-related activities involving user interactions and data collection. The project ensures that all data collected is stored securely and used exclusively for project-related purposes. For sensitive financial data, such as that managed by the Financial Manager, storage is limited to secure, project-designated computers, and all data will be deleted once financial obligations are fulfilled.

Within the SQAT system, certain data sets are stored in a secure database with access restricted to authorised users only. This measure ensures that confidential data is not shared outside the consortium unless explicitly authorised. Additionally, data stored on the platform is protected by robust IT security protocols, including encryption and access controls, to prevent unauthorised access or breaches.

As the project progresses and data management evolves, data stored for internal project purposes will remain protected under the established security protocols. Upon the project's completion, select data may be made publicly available, but this will be regulated by the overarching data management plan, ensuring continued compliance with privacy standards.

In areas where specific data protection measures have yet to be fully defined, the project team remains committed to developing and implementing appropriate safeguards to ensure that all data handling aligns with legal, ethical, and security requirements.

4 Conclusion

The objective of this deliverable was to present an initial version of the DMP for the SQAT project, as available by Month 8. Guided by the FAIR principles outlined in the European Commission's Guidelines, this document has detailed:

(i) the types of data the project will collect and generate,

(ii) the roles & responsibilities regarding data collection & intellectual property considerations,

(iii) the strategies for data exploitation and accessibility for reuse,

(iv) the methods for data curation and preservation, and

(v) the technical and procedural measures implemented to protect privacy within the SQAT platform.

This deliverable primarily summarised the data management plans for each Work Package (Section 2), based on inputs provided by the respective Work Package Leaders, followed by an analysis of the overall data strategy in line with the task requirements.

The analysis indicates that, despite the early stage of data collection, Work Package Leaders generally have a clear understanding of the scale, size, and nature of the data sets to be managed. Specifically, two main categories of data have been identified: personal data associated with communication activities and

geographical data, such as climate and soil data, often linked to pilot studies. The latter category also includes data from the Copernicus program, whose management will be further explored as the project progresses and will be addressed in future versions of this deliverable. Regarding personal data, appropriate measures are in place to ensure compliance with relevant regulations. For geographical data, it is clear how the data collection aligns with the project's objectives.

This deliverable is intended to be a living document. As the project advances, the next steps will include more clearly outlining how data sets are curated and preserved, and, where relevant, how data will be exploited and reused. These updates will be provided in future deliverables, such as the D1.4 SQAT project assessment and potentially in periodic project reports.

5 Appendices

5.1 Appendix I

Input Request sent to SQAT consortium for details required by D4.1.

SQAT | Deliverable 4.1 - Data Management Plan

WP4 is dedicated to the key aspects of data management & governance. In this form, we'd like to understand what new & existing data you will capture and maintain as part of the SQAT project.

Leaders of WP4 would like to invite all partner leaders (or delegated task champions) to fill out this form to the best of their ability.

* Indicates required question

1. Email *

2. Your name: *

3. Partner Organisation Name: *

4. What work package are you leading/primarily involved in? *

Mark only one oval.

- ◯ WP1
- ◯ WP2
- ◯ WP3
- ◯ WP4
- ◯ WP5
- ◯ WP6

5. Will you be creating new datasets or incorporating historical datasets into the SQAT Project? *

Mark only one oval.

- ◯ Yes *Skip to question 6*
- ◯ No *Skip to section 3 (Thank you for your time!)*

Dataset Discovery & Exploration

6. **Multiple responses possible:** Please list any ***new*** datasets you will be collecting as part of SQAT. *

Include:

-**Name of the dataset**
-**Data types** (Numerical, Spatial, Text, Categorical, etc.)
-**Data format** (CSV, .shp, GeoJSON, etc.)
-**Format of collection** (Paper form, Digital entry, In-Field Sensor, Survey, etc.)
-**Expected size** (1-100 entries, 101-1000 entries, 1001-10000 entires, 10000+ entries)
-**Data capture frequency** (Annual, bi-annual, quarterly, etc.)
-**Data temporality** (Real-time, periodic, historical)
-**Data origin** (Internal systems, External source, Manual entry, etc.)
-**Data location** (Ireland, Poland, etc.)
-**Data license** (Public Domain, Creative Commons, Open Data Commons, Proprietary Licenses, etc.)
-**Data access** (Internal, Customer access, Public access)
-**Data sensitivity** (Personal Identifiable Information, Sensitive Personal Information, Confidential Business Information, Security Information, Regulatory Compliance, etc.)
-**Data retention** (how long the data will be held until disposal/archival? or n/a)

eg. 1. Soil Organic Carbon, numerical, CSV, In-field capture, 10000+ entries, Bi-Annual, periodic, Internal Systems, Ireland, Proprietary Licenses, Internal / Customer access, no sensitivity issues, n/a.
2. Farm Boundary, spatial, .shp / GeoJSON, digital entry, 1001-10000 entries, Multi-annual, periodic, manual entry, Ireland, Creative Commons, Internal access, sensitive personal Information, 5 years.

7. Will **existing** data be used? *

Mark only one oval.

- ◯ Yes
- ◯ No

8. **If yes, Multiple responses possible:** Please list any ***existing*** datasets you will be including in SQAT.

Include the **status of data collection,** name of the
Include:

-**Status of Data Collection** (Ongoing, Complete, etc.)
-**Name of the dataset**
-**Data types** (Numerical, Spatial, Text, Categorical, etc.)
-**Data format** (CSV, .shp, GeoJSON, etc.)
-**Format of collection** (Paper form, Digital entry, In-Field Sensor, Survey, etc.)
-**Expected size** (1-100 entries, 101-1000 entries, 1001-10000 entires, 10000+ entries)
-**Data capture frequency** (Annual, bi-annual, quarterly, etc.)
-**Data temporality** (Real-time, periodic, historical)
-**Data origin** (Internal systems, External source, Manual entry, etc.)
-**Data location** (Ireland, Poland, etc.)
-**Data license** (Public Domain, Creative Commons, Open Data Commons, Proprietary Licenses, etc.)
-**Data access** (Internal, Customer access, Public access)
-**Data sensitivity** (Personal Identifiable Information, Sensitive Personal Information, Confidential Business Information, Security Information, Regulatory Compliance, etc.)
-**Data retention** (how long the data will be held until disposal/archival? or n/a)

eg. 1. Ongoing, Soil Organic Carbon, numerical, CSV, In-field capture, 10000+ entries, Bi-Annual, periodic, Internal Systems, Ireland, Proprietary Licenses, Internal / Customer access, no sensitivity issues, n/a.
2. Complete, Farm Boundary, spatial, .shp / GeoJSON, digital entry, 1001-10000 entries, Multi-annual, periodic, manual entry, Ireland, Creative Commons, Internal access, sensitive personal Information, 5 years.

9. What SQAT project objectives does the collected data relate to? *

10. What measures are taken to comply with personal data protection principles? *

11. Does your team have a data cleaning methodology in place for your collected datasets? *

12. How many people on your team will be involved in the collection and management of your collected data? *

13. Are there any policies / regulations / laws that your data is required to align with? *

14. Thank you for your time in completing our survey. *

We would like to invite you to a follow-up discussion to offer a chance for a more dynamic conversation on this topic.

Could you please offer 3 separate dates and times that would suit you best to meet in the next 1-3 weeks below:

Thank you for your time!

No further action is required here.

5.2 Appendix I

Input from all SQAT survey participants.

Timestamp	Email Address	Your name:	Partner Organisation Name:	What work package are you leading/ primarily involved in?	Will you be creating new datasets or incorporating historical datasets into the SQAT Project?	Multiple responses possible: Please list any new datasets you will be collecting as part of SQAT. Include: -Name of the dataset -Data types (Numerical, Spatial, Text, Categorical, etc.) -Data format (CSV, .shp, GeoJSON, etc.) -Format of collection (Paper form, Digital entry, In-Field Sensor, Survey, etc.) -Expected size (1-100 entries, 101-1000 entries, 1001-10000 entires, 10000+ entries) -Data capture frequency (Annual, bi-annual, quarterly, etc.) -Data temporality (Real-time, periodic, historical) -Data origin (Internal systems, External source, Manual entry, etc.) -Data location (Ireland, Poland, etc.) -Data license (Public Domain, Creative Commons, Open Data Commons, Proprietary Licenses, etc.) -Data access (Internal, Customer access, Public access) -Data sensitivity (Personal Identifiable Information, Sensitive Personal Information, Confidential Business Information, Security Information, Regulatory Compliance, etc.) -Data retention (how long the data will be held until disposal/archival? or n/a)	Will existing data be used?	If yes, Multiple responses possible: Please list any existing datasets you will be including in SQAT. Include the status of data collection, name of the Include: -Status of Data Collection (Ongoing, Complete, etc.) -Name of the dataset -Data types (Numerical, Spatial, Text, Categorical, etc.) -Data format (CSV, .shp, GeoJSON, etc.) -Format of collection (Paper form, Digital entry, In-Field Sensor, Survey, etc.) -Expected size (1-100 entries, 101-1000 entries, 1001-10000 entires, 10000+ entries) -Data capture frequency (Annual, bi-annual, quarterly, etc.) -Data temporality (Real-time, periodic, historical) -Data origin (Internal systems, External source, Manual entry, etc.) -Data location (Ireland, Poland, etc.) -Data license (Public Domain, Creative Commons, Open Data Commons, Proprietary Licenses, etc.) -Data access (Internal, Customer access, Public access) -Data sensitivity (Personal Identifiable Information, Sensitive Personal Information, Confidential Business Information, Security Information, Regulatory Compliance, etc.) -Data retention (how long the data will be held until disposal/archival? or n/a)	What SQAT project objectives does the collected data relate to?	What measures are taken to comply with personal data protection principles?	Does your team have a data cleaning methodology in place for your collected datasets?	How many people on your team will be involved in the collection and management of your collected data?	Are there any policies / regulations / laws that your data is required to align with?	Thank you for your time in completing our survey. We would like to invite you to a follow-up discussion to offer a chance for a more dynamic conversation on this topic. Could you please offer 3 separate dates and times that would suit you best to meet in the next 1-3 weeks below:
4/17/2024 9:	svogel@atb-potsdam.de	Sebastian Vogel	ATB	WP3	Yes	Multiple responses possible: Please list any new datasets you will be collecting as part of SQAT. Include: -Name of the dataset -Data types (Numerical, Spatial, Text, Categorical, etc.) -Data format (CSV, .shp, GeoJSON, etc.) -Format of collection (Paper form, Digital entry, In-Field Sensor, Survey, etc.) -Expected size (1-100 entries, 101-1000 entries, 1001-10000 entires, 10000+ entries) -Data capture frequency (Annual, bi-annual, quarterly, etc.) -Data temporality (Real-time, periodic, historical)	Yes	1. Ongoing, Satellite images, Spatial (raster), GeoTIFF, Remote Sensing, 10000+ entries, once, historical, External source, Germany, Public Domain, Public access, no sensitivity issues, n/a 2. Ongoing, Elevation data, Spatial (raster), GeoTIFF, Remote Sensing, 10000+ entries, once, historical, External source, Germany, Public Domain, Public access, no sensitivity issues, n/a	- Specific Objective 1: Develop an integrated system for high resolution soil-mapping – combining Copernicus data , an autonomous robotic platform, proximal sensing, and a novel lab-on-the-field soil analysis module.	Personal data will only used internally and not be made public without the permission of the data owner.	Yes, but data cleaning methodology (e.g. outlier removal) needs to be adjusted for SQAT.	2	Apart from data protection, not to our knowledge.	- Friday, 25 April, 9:00-12:00 or 13:00-16:00 - Thursday, 2 May, 13:00-16:00 - Friday, 3 May, 13:00-16:00
4/18/2024 1(	dusan.jovanovic@terracontrolling.rs	Dušan Jovanović	Terra Controlling TMD	WP2	Yes	1. Farm Boundary, spatial, shp, digital entry, 1001-10000 entries, Multi-annual, periodic, manual entry, Serbia, Creative Commons, Internal access, sensitive personal Information, 5 years. 2. Raster zones base on satellite images VI and BSI, raster, tiff, digital, 10000+, Multi-annual, periodic and historical, Internal systems or External source or Manual entry, Serbia, Proprietary License, Internal/Customer access, Personal Identifiable Information, 5 years 3. Basic chemical analysis of the soil (pH, NPK) and microelements in the soil, Numerical and Text, XLSX and PDF, paper form and Digital entry, 1001-10000, monthly, periodic, ordinary manual entry sometimes and external source, Serbia, Proprietary Licenses, Internal/Customer access, Regulatory Compliance, 5 years 4 Maps created on the results of soil analysis, raster and vector, digital, 10000+, Multi-annual, periodic, Internal systems or Manual entry, Serbia, Proprietary License, Internal/Customer access, Personal Identifiable Information, 5 years	Yes	1. Farm Boundary, spatial, shp, digital entry, 1001-10000 entries, Multi-annual, periodic, manual entry, Serbia, Creative Commons, Internal access, sensitive personal Information, 5 years. 2. Raster zones base on satellite images VI and BSI, raster, tiff, digital, 10000+, Multi-annual, periodic and historical, Internal systems or External source or Manual entry, Serbia, Proprietary License, Internal/Customer access, Personal Identifiable Information, 5 years 3. Basic chemical analysis of the soil (pH, NPK) and microelements in the soil, Numerical and Text, XLSX and PDF, paper form and Digital entry, 1001-10000, monthly, periodic, ordinary manual entry sometimes and external source, Serbia, Proprietary Licenses, Internal/Customer access, Regulatory Compliance, 5 years 4 Maps created on the results of soil analysis, raster and vector, digital, 10000+, Multi-annual, periodic, Internal systems or Manual entry, Serbia, Proprietary License, Internal/Customer access, Personal Identifiable Information, 5 years	Collected data is related to the use cases SQAT smart soil mapping system and SQAT Smart Farming Applications (Variable rate macronutrient fertilisation and Variable rate sowing)	all measures according to the GDPR	No	3	Yes, Local and National laws	26.04.2024 10AM-13PM 09.05.2024 11AM-13PM 10.05.2024 10AM-14PM
4/25/2024 1(	srdjan@balkanecoinnovations.org	Srđan Pavlović	The Association of Balkan Eco-Innovations	WP1	Yes	WP1 Name: Contact list SQAT Data type: text Data format: xlsx Format of collection: Digital entry Expected size: 1-100 entries Data capture frequency: once at the beginning of the project and ad-hoc during the project (e.g. inclusion of new team member). Data temporality: Real time Data origin: Manual entry Data location: European Union Data license: N/A Data access: Internal Data sensitivity: Personal Identifiable Information Data retention: Data will be archived at the end of the Project (M42) WP5 Name: Dissemination tracker Data type: text Data format: xlsx Format of collection: Digital entry Expected size: 1-100 entries Data capture frequency: Adhoc. Data temporality: Real time Data origin: Manual entry Data location: European Union Data license: N/A Data access: Internal Data sensitivity: Personal Identifiable Information; Data retention: Data will be archived at the end of the Project (M42) Name: Ambassador list Data type: text Data format: xlsx Format of collection: Digital entry Expected size: 1-100 entries Data capture frequency: Adhoc. Data temporality: Real time Data origin: Manual entry Data location: European Union Data license: N/A Data access: Internal Data sensitivity: Personal Identifiable Information; Data retention: Data will be archived at the end of the Project (M42) Name: Travel sheet Data type: text Data format: xlsx Format of collection: Digital entry Expected size: 1-100 entries Data capture frequency: Adhoc. Data temporality: Real time Data origin: Manual entry Data location: European Union Data license: N/A Data access: Internal Data sensitivity: Personal Identifiable Information; Data retention: Data will be archived at the end of the Project (M42)	No		WP1 - To ensure coordination and management of all activities within the project. WP5 - Form the communication team and develop a structured plan-based approach (ECDS) to disseminate and communicate, facilitating coordination between partners and ensuring coherence and impact; Disseminate insights and results to different audiences to promote expected outcomes and wider impact.	All datasets are going to be located in OneDrive folder: SQAT project. SQAT project folder is shared with team members via dedicated link which is sent to team member's email address.	N/A	3	GDPR.	29.04. (Thursday) 13:00-14:00 CEST 09.05. (Wednesday) 15:00-16:00 CEST 10.05. (Friday) 15:00-16:00 CEST Note: this form was filled out both for WP1 and WP5
4/25/2024 1!	luis.meier@ost.ch	Luis Meier	OST	WP2	No									

Timestamp	Email Address	Your name:	Partner Organisation Name:	What work package are you leading/ primarily involved in?	Will you be creating new datasets or incorporating historical datasets into the SQAT Project?	Multiple responses possible: Please list any new datasets you will be collecting as part of SQAT. Include: -Name of the dataset -Data types (Numerical, Spatial, Text, Categorical, etc.) -Data format (CSV, .shp, GeoJSON, etc.) -Format of collection (Paper form, Digital entry, In-Field Sensor, Survey, etc.) -Expected size (1-100 entries, 101-1000 entries, 1001-10000 entires, 10000+ entries) -Data capture frequency (Annual, bi-annual, quarterly, etc.) -Data temporality (Real-time, periodic, historical) -Data origin (Internal systems, External source, Manual entry, etc.) -Data location (Ireland, Poland, etc.) -Data license (Public Domain, Creative Commons, Open Data Commons, Proprietary Licenses, etc.) -Data access (Internal, Customer access, Public access) -Data sensitivity (Personal Identifiable Information, Sensitive Personal Information, Confidential Business Information, Security Information, Regulatory Compliance, etc.) -Data retention (how long the data will be held until disposal/archival? or n/a)	Will existing data be used?	If yes, Multiple responses possible: Please list any existing datasets you will be including in SQAT. Include the status of data collection, name of the Include: -Status of Data Collection (Ongoing, Complete, etc.) -Name of the dataset -Data types (Numerical, Spatial, Text, Categorical, etc.) -Data format (CSV, .shp, GeoJSON, etc.) -Format of collection (Paper form, Digital entry, In-Field Sensor, Survey, etc.) -Expected size (1-100 entries, 101-1000 entries, 1001-10000 entires, 10000+ entries) -Data capture frequency (Annual, bi-annual, quarterly, etc.) -Data temporality (Real-time, periodic, historical) -Data origin (Internal systems, External source, Manual entry, etc.) -Data location (Ireland, Poland, etc.) -Data license (Public Domain, Creative Commons, Open Data Commons, Proprietary Licenses, etc.) -Data access (Internal, Customer access, Public access) -Data sensitivity (Personal Identifiable Information, Sensitive Personal Information, Confidential Business Information, Security Information, Regulatory Compliance, etc.) -Data retention (how long the data will be held until disposal/archival? or n/a)	What SQAT project objectives does the collected data relate to?	What measures are taken to comply with personal data protection principles?	Does your team have a data cleaning methodology in place for your collected datasets?	How many people on your team will be involved in the collection and management of your collected data?	Are there any policies / regulations / laws that your data is required to align with?	Thank you for your time in completing our survey. We would like to invite you to a follow-up discussion to offer a chance for a more dynamic conversation on this topic. Could you please offer 3 separate dates and times that would suit you best to meet in the next 1-3 weeks below:	
6/1/2024 14:	tamme.vanderw	Tamme	AeroVision	WP6	Yes	(yes we want farm AND field boundaries too - do I need to describe that here too?) 1. Soil Zone map, spatial (timestamped), GeoTIFF, digital file, 1 entry per field, annual (at the most), pe 2. Point soil sampling lab analysis results, numerical (location and time based), XLS or CSV, digital file,	Yes	1. bare soil satellite imagery SENTINEL2, spatial (timestamped), 2. bare soil satellite imagery PLANET-SUPERDOVE, spatial (tim 3. digital terrain map, spatial (if available), GeoTIFF, digital file, 1	SO1, the exploitation of c	none, customer data are	uhhhhh, I guess ... but nc	2 or 3.	No, however some stand	let's sort out via email.	
8/13/2024 1(	axel.willekens@	Axel Willeker	ILVO	WP2	Yes	The data will be stored in time series database (10000+). The data captured is related to the parameter	No		Robot and sampling syst	Anonymisation	All original data is mainta	4	GDPR if applicable	if still applicable you can contact us	

End of document