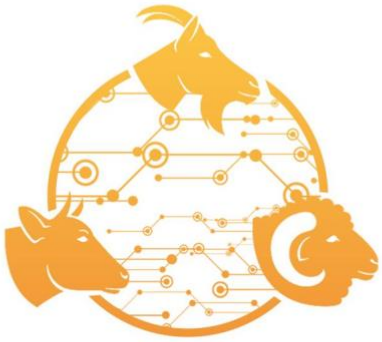

Del. 5.3 – Sustainability and Upscaling Plan

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Contents

1. Introduction

This report aims to provide a structured roadmap for the continued exploitation and development of SEBASTIEN products and services beyond the project's end in October 2024.

The report outlines the sustainability plan for the SEBASTIEN project products—namely data, algorithms, software, services, platforms (for both processing and exploitation), and other documentation or materials—post-project completion in October 2024.

The primary aim of the sustainability plan is twofold: first, to ensure the continued availability, promotion, and access to these products, while fostering further exploitation, updates, upgrades, or in-depth development; and second, to identify specific actions that project partners should undertake to enable such future developments.

The objectives of the sustainability plan are:

1. Summarizing SEBASTIEN products and their availability after the project ends, including licensing and intellectual property rights (IPR) considerations.
2. Identifying potential enablers or barriers for the future development of non-commercial demonstrators into pre-operational services for various user groups.

Key elements necessary for the exploitation and sustainability of SEBASTIEN products will be synthesized, considering access, target groups, and possible sources of funding, among others.

2. SEBASTIEN Services

This section provides an overview of the SEBASTIEN services.

2.1. Service 1

The general aim of Service 1 is to support livestock farming in mitigating the effects of climate change, both in the short and long term. The service has been divided into three sub-services to meet the diverse needs of stakeholders:

- **Service 1.a** developed and implemented a machine learning (ML) model for evaluating heat stress on livestock production (both quantitative and qualitative characteristics of milk). Short-term (2-day) weather forecasts (using COSMO-2I data) and long-term climate projections (using VHR-PRO data) from the HIGHLANDER and CMCC systems were utilized.

- **Service 1.b** focused on identifying cattle breeds with greater genetic resilience to adverse environmental conditions, aiming to select animals that can transmit their resilience to future generations. This service evaluated the adaptation of different breeds to stressful

environmental conditions, such as Temperature-Humidity Index (THI) both inside and outside the barn.

2.2. Service 2

Service 2 focused on assessing THI within livestock barns, which was used in conjunction with Service 1.a to evaluate heat stress in cattle. Artificial intelligence (AI) was used to model the relationship between input parameters and THI values. The service is made up of two sub-services:

- **Service 2.a** estimated the variation of THI within a stable over the next two days, using factors like the stable's latitude, longitude, altitude, and external THI values.

- **Service 2.b** projected how THI inside a stable would change due to climate change, under RCP4.5 and RCP8.5 scenarios, for near- and long-term horizons. The goal was to help users plan adaptation actions, such as designing climate-proof stable setups that reduce heat stress on livestock.

2.3. Service 3

Service 3 provided monitoring tools for extensive farming, where constant supervision of animals and feed availability is not possible. By utilizing satellite data to observe vegetation conditions, the service enabled farmers to schedule grazing availability and detect overgrazing. Satellite data was combined with pasture field data in a statistical model to assess pasture productivity and characteristics.

2.4. Service 4

Service 4 focused on managing the spread of diseases caused by parasites (e.g., Bluetongue in sheep) and other health conditions (e.g., mastitis in cattle). It used data from various sources—climatic, environmental, and farm management conditions—to train models that predicted disease risk under climate projections. This service provided risk maps for the spread of parasites and diseases.

- **Service 4.a** employed machine learning to produce future maps for the probability of Bluetongue in sheep in Sardinia.

- **Service 4.b** assessed the impact of environmental stressors (e.g., heat stress) on the somatic cell count (SCC) in milk, an important indicator of mammary gland health and milk quality.

3. Project Assets

3.1. Overview

The SEBASTIEN project produces several types of assets, categorized as follows:

- Data
- Algorithms for data pre-processing, processing, and post-processing
- Platforms and services for data exploitation and service delivery
- Web-based tools and dissemination products

These assets can be categorized into two groups based on their sustainability potential:

- **Internally maintained assets**: Products that will continue to be updated and maintained by project partners after the project ends.

- **Externally exploitable assets**: Products that can be used or maintained by external stakeholders and do not require regular updates from project partners. These may include reports, maps, images, and other "ready-to-use" materials.

Table 1 provides an overview of SEBASTIEN products, their associated licenses, and owners.

ID	Products	License	Owner
1	Datasets	Open	SEBASTIEN
2	Algorithms (pre- to post-processing)	Open	SEBASTIEN
3	Dissemination products/elaborations	Open	SEBASTIEN
4	Platform	Open/Apache 2.0	SEBASTIEN
5	Website/Exploitation portals/tools	Open	SEBASTIEN

These categories and assets were evaluated in terms of sustainability during project consultations with service leads and contributors (via questionnaires), with results analyzed in the subsequent sections.

3.2. Sustainability of Service Components

A total of 19 responses to the questionnaires were received, ensuring that all SEBASTIEN services are adequately represented. Service 2 and Service 3 saw a slightly higher number of responses.

Figure 1: Share of respondents among Services

Regarding product maintenance (Figure 2), datasets will mostly be internally maintained (8 responses), while others (7 responses) will remain available but without updates. Some (5 responses) will be maintained externally. The most external maintenance (14 responses) was expected for elaborations (e.g., maps, graphs), and many algorithms (15 responses) will continue to be fine-tuned, while only a few (3 responses) will be open for external exploitation.

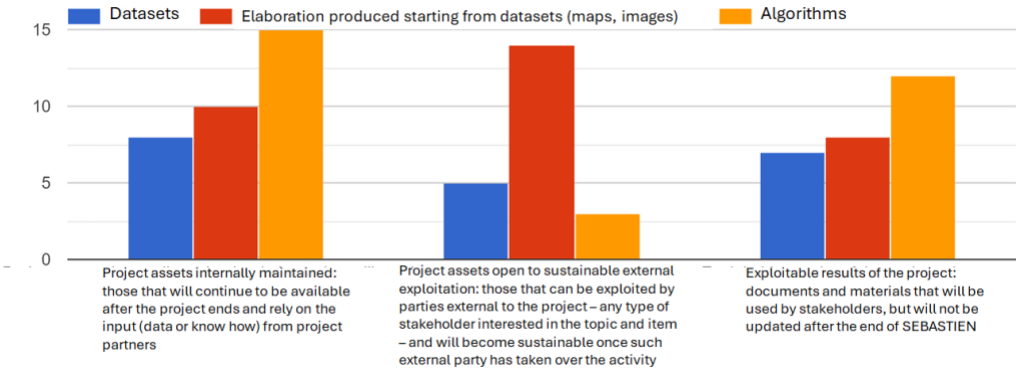

Figure 2: Type of products and exploitation horizon/level

In terms of licenses (Figure 3), around 70% of respondents noted that the licensing for products has not yet been defined, while 20% indicated that products are licensed under CC BY 4.0.

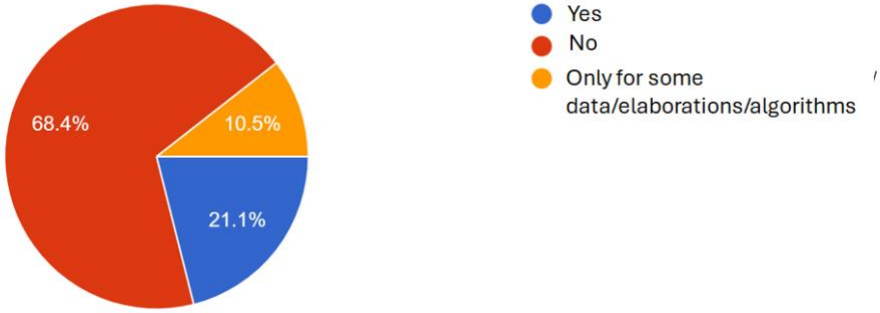

Figure 3: License definition for services

Most respondents (84%) expressed an interest in continuing collaboration through agreements, with the vast majority (90%) suggesting that collaboration agreements should involve all partners, not just the service leader.

Figure 4: Requirements for next development of the Services

3.3. Platform and Web Service Portal Sustainability

The SEBASTIEN Data Delivery System (DDS) portal hosts SEBASTIEN services and provides access to results such as maps and graphs. It is based on a modular architecture, ensuring that components can be updated independently and integrated into other platforms to lower maintenance costs.

SEBASTIEN's DDS platform, built on HIGHLANDER project architecture, will be maintained post-project. Several projects, such as **SDGs-EYES** and **SILVANUS**, will support the platform's continuation and development, leveraging many of the DDS components for other environmental monitoring purposes.

4. Sustainability Enablers and Barriers

4.1. Data Availability

The need for regular and consistent updates of input data is one of the main constraints. However, the ongoing availability of high-quality data from Copernicus services (e.g., climate projections, satellite data) and CMCC's high-resolution downscaling efforts will support continued access to key datasets. Collaboration with stakeholders like farmers' associations is also expected to facilitate the availability of new, sector-specific data.

4.2. Financial Resources

Several funding opportunities have been identified to support the continuation of SEBASTIEN services. The Horizon Europe 2025 Work Programme offers relevant calls, including those focused on animal health, welfare, and climate change adaptation in farming (see Table 2).

Table 2 – Potential calls in the Horizon Europe Work Programme 2025 as a follow-up to SEBASTIEN

Cluster 6 - Food, Bioeconomy, Natural Resources, Agriculture and Environment	**Type**	**M€**	**N. expected projects**	**Note**
HORIZON-CL6-2025-02-FARM2FORK-02: Additional activities for the European partnership on animal health and welfare	RIA	12	2	50% cofin; The proposal must be submitted by the coordinator of the consortium funded under HORIZON-CL6-2023-FARM2FORK-01-2 (where partner UNITUS is involved)
HORIZON-CL6-2025-02-FARM2FORK-08: Fostering animal breeding and genetics for climate change adaptation and mitigation, improved robustness and resilience	RIA	12	2	
HORIZON-CL6-2025-02-FARM2FORK-07: Improving grassland management in European livestock farming systems	RIA	16	2	

Partners will also seek additional national and international funding opportunities to continue the work initiated by SEBASTIEN.

Annex 1 - Questionnaire

The questionnaire provides insights into the sustainability strategy, product categorization, and the plans for further development and collaboration. Key questions focus on the classification of SEBASTIEN outputs (datasets, elaborations, algorithms), licensing status, and the interest of partners in continuing service development after the project.

a) Which Service are you filling out this form? If, as an organization, you are involved in more than one Service, we kindly ask you to fill out a form for each of the Services.

Service 1 - Coping with environmental stressors for breeds to support livestock farming towards breed adaptation to environmental conditions and production needs.

Service 2 - Intensive farming risk management under climate extremes to alert about approaching or projected dangerous environmental circumstances for cattle.

Service 3 - Extensive farming management and feed availability based on indicators/indices about the phenological stage and greening of the naturally vegetated or managed areas used to feed livestock heads when conducted outdoors.

Service 4 - Livestock farming under risks from combined abiotic and biotic factors to provide updated risk maps of parasites and diseases spread.

b) Indicate, with reference to the Service for which you are filling out the form, how you would classify the outputs of the Service based on the three types of assets identified.

	Datasets	**Elaborations produced from datasets (maps, images)**	**Algorithms**
Project assets internally maintained: those that will continue to be available after the project ends and rely on the input (data or know how) from project partners			
Project assets open to sustainable external exploitation: those that can be exploited by parties external to the project – any type of stakeholder interested in the topic and item – and will become sustainable once such external party has taken over the activity			
Exploitable results of the project: documents and materials that will be used by stakeholders, but will not be updated after the end of SEBASTIEN			

c) Has a license been defined for the data/processing/algorithm output from the Service?

1. Yes
2. No
3. Only for some data/processing/algorithms

d) Only if you have indicated that a license has been defined for all or some datasets/processing/algorithms output from the Service, can you tell us which type of license?

(open answer)

e) Select the option that most applies to the Service with reference to its potential development from the perspective of your organization (only one possible choice)

1. We are not interested in further developing the Service
2. The future development of the Service is limited by the need to have a regular and constant updating of the input data
3. We are willing to develop collaboration agreements for further development of the Service
4. Agreements are already in place for the further development of the Service
5. The Service will be further developed directly by the partners involved

f) For a further development of the service starting from the Service carried out in SEBASTIEN it is necessary:

1. Sign a collaboration agreement with all the partners involved in the implementation of the Service
2. Sign a collaboration agreement with the Service lead

g) Is the further development of the Service envisaged, even if only partially, in a new European project (even if only "submitted"/"in preparation")?

1. Yes
2. No

h) We ask you to include in this section some information on European projects in which it is planned to further develop the Service. The project is (if there are multiple projects in different categories below, you can select more than one category):

1. 1) in preparation
2. 2) "submitted" pending evaluation
3. 3) financed (under negotiation or ongoing)
4. 4) nothing in preparation

i) Only if you have indicated 1), 2) or 3) to the previous question, could you give us some more brief information for each project or proposal? (e.g. funding program, project title/acronym, duration, partner, budget, if in preparation, submitted or approved/ongoing?)

(open answer)