SEBASTIEN

Smarter livEstock Breeding through Advanced Services Tailoring Innovative and multi-sourcE data to users' Needs

.

Third Semester Activity Report

January – June 2023

European Commission Health and Digital Executive Agency (HaDEA) **Connecting Europe Facility**	**Interim report**

1. INFORMATION ON THE ACTION

Grant Agreement Nº	INEA/CEF/ICT/A2020/2373580
Action Title (Art. 1 of G.A.)	SEBASTIEN
Action number (Art. 1 of the G.A.)	2020-IT-IA-0234

Author of the report

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2. IMPLEMENTATION OF THE ACTION[1]

2.1. Overall completion of the Action

Planned Start/End date[2]		Actual Start/End date		Completion[3]
Jan 2022	Jun 2024	Jan 2022	Jun 2024	50%

2.2. Completion per activity/work package

Activity 1	Title[4]	Planned Start/End date[3]		Actual Start/End date		Completion
	Project Coordination and Management	M1	M30	M1	M30	50%
Milestone no	**Title[3]**	**Planned date[3]**		**Actual date**		**Reached (Y/N)**
2	Third progress report	M18		M18		Y

Activity 2	Title[3]	Planned Start/End date[3]		Actual Start/End date		Completion
	Outlining geospatial to livestock data gathering, processing and integration steps	M1	M18	M1	M21	75%
Milestone no	**Title[3]**	**Planned date[3]**		**Actual date**		**Reached (Y/N)**
4	Report on data synthesis	M18		M21		N

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[1] For Interim report: please describe the completion of the action until the end of the reporting period as specified in the Grant Agreement.

[2] As specified in Art. 2.2 of the Grant Agreement.

[3] The completion of the Action and of each activity/work package should be indicated as a percentage.

[4] As specified in the Grant Agreement.

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Activity 3	Title[3]	Planned Start/End date[3]		Actual Start/End date		Completion
	Data platform for livestock management	M6	M27	M6	M27	45%
Milestone no	**Title[3]**	**Planned date[3]**		**Actual date**		**Reached (Y/N)**
5	Report on data lake	M15		M15		Y

Activity 4	Title[3]	Planned Start/End date[3]		Actual Start/End date		Completion
	Stakeholders involvement: from co-design to co-evaluation	M1	M30	M1	M30	45%
Milestone no	**Title[3]**	**Planned date[3]**		**Actual date**		**Reached (Y/N)**
No milestones expected						

Activity 5	Title[3]	Planned Start/End date[3]		Actual Start/End date		Completion
	Outreach and sustainability	M1	M30	M1	M30	60%
Milestone no	**Title[3]**	**Planned date[3]**		**Actual date**		**Reached (Y/N)**
No milestones expected						

Activity 6	Title[3]	Planned Start/End date[3]		Actual Start/End date		Completion
	Open Data and Services Exploitation Portal for the livestock sector	M1	M30	M1	M30	50%

Milestone no	Title[3]	Planned date[3]	Actual date	Reached (Y/N)

14	Open data policy report	M12	M15	Y

2.3. Description of the implementation of the Action, including the actual status at the end of the Action (or of the reporting period) and possible deviations from the planned activities, and, if applicable, compliance with any relevant specific provisions as indicated in the Annex I of the GA

Activity 1 - Project coordination and management

Task 1.1: *Management of the Action (M1-M30)*
Task 1.2: *Financial Management (M1-M30)*

Description of activities

Main outputs achieved (as per GA and milestones):

- Third progress report

The following activities have been performed:
- Planning and coordination of monthly Activity Leaders meetings
- Planning and organization of periodic Project Management Board meetings
- Organization of the midterm General Assembly at CMCC Headquarters
- Coordination and management of technical and scientific activities, particularly focusing on the deviations related mainly to Activity 2 and Activity 3.
- Monitoring of financial aspects of the Action, with particular focus on the delays regarding Equipment expenditure in Activity 2.
- Implementation and signing of the agreements with IZS Sardegna (useful for Service 4 data provisioning) and ANAPRI (useful for Service 1 data provisioning).

Milestones:

- no. 2 - Progress report

Deliverables:

- D1.1 *Mid-term activity report (technical and financial)*
  As agreed with the Project Officer, this deliverable is no longer required.

Lead partner: CMCC

Other contributing partners: All

Activity 2 - Outlining geospatial to livestock data gathering, processing and integration steps

Task 2.1: *Review and pre-selection of indicators/indices (M1-M3)*
Task 2.2: *Identify existing data sources and ways for access and extraction (M4-M9)*
Task 2.3: *Designing of new project-customized variables (M1-M6)*
Task 2.4: *Planning data elaboration and integration steps (M7-M18)*

Description of activities

Main outputs achieved (as per GA and milestones):

- None

The following activities have been performed:

- Active participation in services definition. Interaction with other Activities (3, 4 and 6) to develop the four services envisaged in Activity 6.
- Testing the input data identified for the Services.
- Testing Machine Learning (ML) pipelines in HPC systems, implementing the analysis and prediction models for the four services.
- Improving the IoT animal and environmental sensors. Developing a new version of IoT animal sensor, using an ear tag (lighter, more comfortable for the animal). Testing the sensor to measure animal heartbeat and temperature through optical technologies.
- Testing IoT data collection server.

Activity deviations

In the context of Activity 2, we are experiencing some delays in data availability, in particular for Services 3 and 4.

For Service 3, the reason is the unexpected unavailability of Rocca Respampani's pastures to evaluate pasture characteristics (i.e., green biomass, dry biomass, etc.) at the beginning of the grazing season (i.e., April). To avoid further delays, two alternative pastures were identified and the collection of on-field data started at the beginning of June. The expectation is to use data from the two pastures to quickly gather a sufficient amount of data for the implementation of the predictive model.

For Service 4, we needed to interact with Sardegna IZS (Istituto Zooprofilattico Sperimentale) to obtain the zoonosis data needed to implement the predictive model. Although contacts began at the beginning of the project, the IZS bureaucracy took a long time to give us access to the data, which happened at the end of June. For all these reasons, there was a general delay in the prediction models implementation and indicators availability.

In addition, delays in IoT sensors availability (animal and environmental sensors) were experienced. First of all, the electronic components supply has taken longer than expected, due to stock shortage initially caused by the pandemic, and that continues even today due to the Ukraine war conditions. Meanwhile, sensor development has not stopped and a higher performance and miniaturized device for IoT animal sensors was produced in the SEBASTIEN framework.

Today the device that will be used in the project is an ear tag, which ensures more comfort for the animal, less loss problem, more acceptance by the farmers, and it is suitable in different field situations.

As a result, the purchase of the necessary materials for large-scale production of the sensors will now be initiated. Consequently, as the next step, the sensors will be used in the fields and will send data to the SEBASTIEN Data Lake.

Milestones:

- *None;* no. 4 - Report on data synthesis - postponed until September 2023

Deliverables:

- *None*

Lead partner: UNITUS

Other contributing partners: AIA, UCSC, CMCC, NATURE4.0, CINECA

Activity 3 – Data platform for livestock management

Task 3.1: *Livestock sector and environmental data gathering (M6-M15)*
Task 3.2: *Data access layer (M10-M21)*
Task 3.3: *Database of environmental, vegetation and physiological conditions' indicators/indices (M13- M27)*

Description of activities

Main outputs achieved (as per GA and milestones):

- Report on the SEBASTIEN data lake, including the extensions implemented over the HIGHLANDER data platform, shared with the Agency

In addition, the following activities have been performed:

- Design of the SEBASTIEN Architecture as an extension of the HIGHLANDER Platform
- Specifications of the different components of the Data Lake: Catalog, Backend, Data Storage, Connectors, Data Access Layer API
- Deployment of the first release of the SEBASTIEN Data Lake with the following extensions:
  - a MetaDB catalog for ingesting data from external providers
  - a new data format (i.e., geojson format) beside NetCDF for the integration of data stored in the Data Lake within the SEBASTIEN Services (web portal and mobile applications)
- Interactions with Activity 2 and 6 to define the datasets to be integrated within the Data Lake and the API to expose for the development of the downstream Services
- Integration of MISTRAL weather forecast data for Service 1

Activity deviations

The delays in Activity 2 in providing the needed data could imply a delay in the release of the Data Access Layer (Milestone 6).

Milestones:
- no. 5 - Report on data lake

Deliverables:
- D3.1 *Report on HIGHLANDER data platform extension implementing SEBASTIEN data lake*

Lead partner: CMCC

Other contributing partners: CINECA, NATURE4.0, UCSC, UNITUS, AIA

Activity 4 - Stakeholders involvement: from co-design to co-evaluation

Task 4.1: *Stakeholders' engagement (M1-M30)*
Task 4.2: *Tailoring data, indicators and tools (M7-M23)*
Task 4.3: *Evaluating the services with stakeholders (M19-M30)*

Description of activities

Main outputs achieved (as per GA and milestones):

- No main outputs expected for the third semester

The following activities have been performed:
- Planning, organization, implementation and coordination of two online meetings to get feedback from the stakeholders on the current development of the services:
  - A first meeting was held on 23rd February, attended by the champion stakeholders: IZSLT (Erminia Sezzi), FAO (Paul Boettcher), and West System (Paolo Negretti).
  - A second meeting held on 10th March was attended by the champion stakeholders: IZSLT (Erminia Sezzi), Stefano Corbianco (Az. Agr. Gioconda), and Consorzio Parmigiano Reggiano (Gaetano Cappelli), and by the stakeholders Az. Agr. Mariotti (Mario Mariotti) and AGRIS (Antonello Carta).
- Interactions with the other Activities in order to progress with the services, specifically with A2 to define input and models based on stakeholders' feedback collected during the meeting.
- Writing and circulation of the meetings minutes and reports.
- Planning of Milestone 9 "Scientific report on final indicators", due in Oct. 2023. By coordinating with A2 and attending and contributing to the weekly meetings on the Services development, we updated the list of indicators that will eventually be provided within Milestone 9 "Scientific report on final indicators".

Activity deviations

Importantly, due to delays in obtaining the data necessary to progress with the development of Services 3 and 4, a consequent delay in producing the upcoming Milestone 9 "Scientific report on final indicators" is to be expected. Moreover, the co-design of these services has been consequently delayed and the stakeholders involved are giving feedback on the basis of the new data being acquired.

Milestones:

- *None*

Deliverables:

- *None*

Lead partner: UCSC

Other contributing partners: UNITUS, CMCC, AI

Activity 5 - Outreach and sustainability

Task 5.1: *Communication and Dissemination (M1-M30)*
Task 5.2: *Lessons learned: toward services sustainability and upscaling (M19-M30)*

Description of activities

Main outputs achieved (as per GA and milestones):
- No main outputs expected for the third semester

The following activities have been performed:
- 4° Outreach team meeting held on January 17th online;
- 5° Outreach team meeting held on May 31st online;
- Creation of news accounting for project progress and workshop/congress/etc. participation, and dissemination on the project social channels;
- Text refinements and approval of the new version of the project video teaser in Italian;
- Creation of the project YouTube channel, uploading teaser videos in both English and Italian versions;
- Several meetings with CMCC and NEATEC to discuss modifications and improvements to the project website (e.g., new sections, Italian page for stakeholders, video teaser, leaflet, media kit, etc.);
- Creation of a new, more intuitive and comprehensive event GANTT template;
- Updating the Dissemination and Communication Plan.

It is worth noting that the abstract presentation entitled "An early warning decision support system for disease outbreaks in the livestock sector" that was given in Vienna at EGU 2023, was also selected for a press conference on "Early warning for extreme events: earthquakes, droughts, floods and livestock disease". The abstract was selected out of 17,000 other abstract submissions as the most exciting and interesting science to share with journalists, thereby increasing public attention and understanding of the SEBASTIEN project.

Milestones:
- *None*

Deliverables:
- *None*

Lead partner: UNITUS

Other contributing partners: All

Activity 6 - Open Data and Services Exploitation Portal for the livestock sector

Task 6.1: *Open Data Policy (M1-M12)*
Task 6.2: *Open Data Catalogue (M1-M30)*
Task 6.3: *Open Data and Services Exploitation Portal (M13-M27)*
Task 6.4: *Visualization and dissemination tools (M13-M27)*

Description of activities

Main outputs achieved (as per GA and milestones):

- Open Data Policy report shared with the agency

In addition, the following activities have been performed:

- Periodic meetings for functional analysis, definition of services and recognition of the datasets necessary for the services organized by CINECA with the participation of CMCC, UNITUS, AIA, UCSC and NEATEC.
- At the end of March, the services working group completed the definition of Services 1, 2 and 3. The partners CMCC, UNITUS, AIA and UNICATT began the activity of creating the machine learning models underlying Services 1 and 2.
- Moreover, the services working group completed the UI/UX design activity of the web tools for Service 1 (Coping with environmental stressors for breeds) and Service 2 (Intensive farming risk management under climate extremes). Concerning Services 3 and 4, mock-up pages have been created.
- Creation of the first version of the mobile App mockups for SEBASTIEN services.
- Creation of the development environment to host Sebastien's Services Exploitation Portal in its own infrastructure and setting up of the Portal backbone:

    https://dds-dev.sebastien.cineca.it/
- Definition of a set of APIs for the implementation of Service 2 functionalities. Implementation of the front-end modules for Service 2 and deployment on the Sebastien's development site. Development of the related API endpoint module with random data generation (mock).

Activity deviations:

The slight delay in the definition of the Portal architecture (D6.2) is due to the slight delay in the development of the models on which Sebastien's four services are based.

Milestones:

- *no. 14 - Open data policy report* (postponed from December 2022 to March 2023)

Deliverables:

- *D6.1 - Compiled descriptive catalogue of background and foreground data expected and suitable for the Open Portal* (postponed from December 2022 to March 2023)
- *D6.2 - Document describing Portal's architecture (postponed from April to September 2023, together with the first release of the portal)*

Lead partner: CINECA

Other contributing partners: CMCC, UNITUS, AIA, UCSC, NATURE4.0, NEATEC

2.4. Conclusions on results of the Action, including the impact of the possible deviation on 1) the objectives of the action, 2) the completion of the planned activities and 3) the cost-breakdown

The Action is progressing well with the planned activities, with most of the milestones delivered on time. However, some delays in data availability for Service 3 "Extensive farming management and feed availability" and Service 4 "Livestock farming under risks" have consequently led to a slippage in Activity 2 and, in particular, in the definition of the predictive models for the production of the Action results.

Moreover, the unavailability of IoT sensors, due to delays in the electronic components' supply chain, didn't allow large-scale production and, as a consequence, installation in the fields and the collection of data for the real time indicators calculation.

These delays brought about a slight deviation in staff allocation and a shift in expenditure for the equipment, which has already been planned for the next months.

Although corrective measures were immediately put in place e, the search for new data to be used in SEBASTIEN led to Milestone 4 "Report on data synthesis" (expected in June 2023) 2 being delayed by three months. As a consequence, Activity 2 also experienced delays that clearly impacted cascading activities such as Activities 3, 4 and 6, where the only tasks that proceeded smoothly and on schedule were those not affected by delays.

However, a contingency plan to mitigate the gap has been discussed with the other partners, and several actions have already been put in place in order to achieve the Action goals, e.g., the identification and exploitation of two alternative pastures to replace the one no longer available.

3. VISIBILITY OF UNION FUNDING

What measures have been taken to publicize the Action, including EU funding (GA II.7.1)?

During the third semester, the SEBASTIEN project was promoted by partners at the following events:

- Crema, 19th January, final event GALA project, intervention on the LEO project (Riccardo Negrini – AIA)
- Viterbo, 22nd to 23rd February, XXIV S.I.P.A.O.C. NATIONAL CONGRESS, presentation entitled "SEBASTIEN: un Sistema di Supporto alle Decisioni per la zootecnia basato su dati ambientali, geospaziali e di settore" (Licia Colli – UCSC)
- Treviglio, April 28th to May 1st, Fiera Agricola 2023
- Bastia Umbra, 1st April, Agriumbria 2023, presentation entitled "Il Progetto LEO: Stato dell'arte sull'accesso ai dati" (Riccardo Negrini – AIA)
- Vienna, 23rd to 28st April, EGU 2023, presentation entitled "An early warning decision support system for disease outbreaks in the livestock sector" selected for a press conference on "Early warning for extreme events: earthquakes, droughts, floods and livestock disease"
- Napoli, 26th to 28th May, MEAVEAS 2023, two presentations entitled "Design of a flexible, expandable, and customizable sensor network for monitoring livestock behaviour and welfare" (Francesco Renzi – UNITUS) and "Machine Learning NIR wavelength selection: application for a low-cost portable instrument for livestock feed management" (Marco Milanesi – UNITUS) that was awarded the Best Conference Paper Award
- Bari, 21st to 26th May, ICAR 2023, presentation entitled "Estimation of enteric methane emission in Italian dairy herds: application of IPCC equations using DHI data" (Riccardo Negrini – AIA)
- Monopoli, 13rd to 16th June, ASPA 2023, poster entitled "SEBASTIEN Smarter livEstock Breeding through Advanced Services Tailoring Innovative and multi-sourcE data to users' Needs" (Mario Barbato – UCSC) and two presentations entitled "Contrasting climate change effects on dairy cattle through Machine Learning approach" (Marco Milanesi – UNITUS) and "Identification of the most impacting environmental variables on dairy cows milk yield using Machine Learning methods" (Daniele Pietrucci – UNITUS)

On April 13-14, 2023, the SEBASTIEN Midterm General Assembly was held in Lecce, Italy, at the headquarters of the Euro-Mediterranean Center on Climate Change (CMCC), with the virtual attendance also of the P.O. Fani Tsirantonaki.

The Action, the funding Agency, and the EU logo have been promoted throughout the various activities carried out also in the third semester of the project, including the official website of the Action and partners' websites, leaflet, various project templates and communication tools.

4. OTHER SOURCES OF EUROPEAN UNION FUNDS

If applicable, provide information about other sources of EU funds (CEF, ERDF, Cohesion Fund, H2020, TEN, EEPR, EIPA, etc.) used for the action (including previous or subsequent phases not covered by the Grant Agreement).

Not applicable.

5. COMPLIANCE WITH EU LEGISLATION

Where relevant, provide information on the compliance with EU legislation regarding other matters (notably public procurement, competition, regulatory matters, etc…).

During the third semester, there haven't been any relevant compliance matters to report.

6. COMPLIANCE WITH CORE PLATFORM AND POLICY

Information on the compliance with the core service, including conformity with relevant technical specifications and alignment with the policy objectives of the Digital Service Infrastructure (as specified in the relevant CEF Telecom Work Programme).

No activities related to compliance have been carried out yet.