D5.6
FINAL BUSINESS CASE IMPLEMENTATION REPORT

Project: Monitoring of Environmental Practices for Sustainable Agriculture Supported by Earth Observation

Acronym: ENVISION

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869366.

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List of Abbreviations

A/A	Abbreviation	Description
1	AB	Advisory Board
2	BAP	Business Cases Action Plan
3	BC	Business Case
4	BCE	Business Case Evaluators
5	BCF	Business Case Facilitator
6	BIG	Business Cases implementation Guide Lines
7	CA	Consortium Agreement
8	CBs	Certification Bodies
9	DP	Data Provider
10	EC	European Commission
11	EnU	End Users
12	EO	Earth Observation
13	EU	European Union
14	LHCs	Lighthouse Customers
15	PAs	Paying Agencies
16	PC	Project Coordinator
17	PP	Platform Provider
18	PSC	Product & Service Consumers
19	SOC	Soil Organic Carbon
20	SP	Services Provider
21	WP	Work Package
22	WPL	Work Package Leader
23	AMS	Area Monitoring System
24	ANC	Areas of Natural Constraint
25	CbM	Checks by Monitoring
26	CSP	CAP Strategic Plan
27	CY	Claim Year
28	DP	Data Product
29	EFA	Ecological Focus Area
30	GAEC	Good Agricultural and Environmental Condition
31	GSA / GSAA	Geo-Spatial Application / Geo-Spatial Aid Application

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32	ISAP	Identification System for Agricultural Parcels
33	LPIS	Land Parcel Identification System
34	NVZ	Nitrate Vulnerable Zones
35	OTSC	On-The-Spot Checks
36	PG	Permanent Grassland
37	QA	Quality Assessment
38	RA	Risk Analysis
39	RDP	Rural Development Program
40	RF	Risk Factor
41	RFV	Rapid Field Visit
42	RP	Reference Parcel
43	SMR	Statutory Management Requirement
44	VHR - HR	Very High Resolution - High Resolution

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Introduction

BC implementation reports aims to identify the current status of BC implementation, ongoing developments and achievements of Envision data products and services with a focus on assessing whether any changes and/or actions are needed based on the lessons learned from BC activities and progress to support the improvement of the ENVISION's data products and services and commercialisation and dissemination activities.

Within this framework, D5.6 "Final Report on BC Implementation" provides a comprehensive overview of the final status of BC implementation, summarizes the work done in previous years, and lessons learned from the progress and notable achievements of Envision data products and services. The report contains a wealth of information for better understanding the concepts, approaches, activities and results achieved during the BC implementation phase.

The structure of D5.6 is based on D5.2 "BC action plan". D5.2 has been developed as a tool to collect detailed information on the execution of each BC, in line with the roles and activities established in the D5.1 guidance. It also provides a BC Gantt Chart with information on the milestones and timely execution of each activity. The contents of the document act as a roadmap for implementation and is used to monitor the progress of each BC. D5.6 focuses on reporting the BC's progress, challenges, mitigation measures, lesson learneds, achievements and milestones.

To give a better understanding of the importance of the BC implementation process in the project, the first section of the deliverable provides an overview of:

- the objectives of WP5 and Task 5.2 and the interaction between Task 5.3 and other WPs
- the strategic and key activities before, during and after the BC implementation process, together with their timelines.

The second section:

- It contains information on the steps and methodology followed in developing the Business Case Progress Report template.
- Describes the progress report template that was circulated to BCs to collect the necessary information.

The third chapter reports

- General information on Business Cases (BCs), progress made during the BC implementation phases, lessons learned and outcomes of the BCs. This information was collected from 20 progress reports submitted (4 for each BC, including 4 for the UK trial study), as well as from routine progress meetings and email exchanges within WP5.
- Involved lighthouse custumers

The final part of the deliverable consists of the overall conclusions supporting the commercialisation and dissemination activities of the ENVISION project in the remaining period.

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1. Introduction WP5 and Task 5.2

1.1 WP5 objectives and the role of Task 5.2 Business Cases Implementation

WP5 main objective is to deploy, test and evaluate ENVISION data products and services developed in WP3 and WP4. In summary, within WP5:

- Products and services developed within WP3 and WP4 are used and tested under different conditions by the Business Customers (BC) and the Lighthouse customers (LC).
- Product and services are evaluated for each business case individually.
- Evaluation results will be used to improve the data products and services (WP3 and WP4) and to support the commercialisation and dissemination activities of the ENVISION project (WP6 and WP7).

In the project, WP5 plays a critical role in ensuring that the services are developed, reach the required maturity and meet specific customer needs concerning the Common Agricultural Policy (CAP) and for the success of commercialisation, dissemination and communication activities (WP6 and WP7).

To support the above goal, Business cases implementation activities are performed within Task 5.2, developed ENVISION platform, data products and services will be used and tested in various business cases under different conditions by the business case partners (the PAs and CBs) and the LHC. They will have the opportunity to use and test the services as close as possible to their actual business practices with the necessary support and guidance they need. This will allow them to gain experience and evaluate services, not in a limited time and environment, but in their actual work environment and a longer timeframe.

More specifically this task aims:

- To facilitate the implementation and monitoring of the performance of the BCs and perform all the needed activities in the right time order using the business case action plans and Gantt as a tool.

- To support the PAs and the CBs (NPA, LV, CAPO, OCS) participating in ENVISION business cases to:
    - Integrate the ENVISION products and services within their legacy systems by providing detailed technical instructions to the users and by sorganising technical sessions and webinars for this reason;
    - Use correctly and efficiently the ENVISION products and services, with the provision of detailed tailor-made user manuals taking into account their needs.

1.2 Task 5.2 Business Cases Implementation and Interactions with Task 5.3 Evaluation of business cases and other WPs

To support a better understanding of the Task 5.2 role within the WP5 and Envision project, we will describe the interactions of the task 5.2 with the other WPs below (Figure 1):

- WP3 designs and develops the EO-enabled data products offered through the ENVISION platform while considering the end user needs identified in WP2.
- WP4 designs and develops all aspects of the ENVISION platform.The identified end-user needs of WP2 feed into WP4, and there is an exchange of information among WP2 and WP4 as the platform and ENVISION service are **co-produced** with the end-users to ensure that they are tailored to their needs
- ***The results of WP3 and WP4 (data products and services) were used and tested within Task 5.2***. Task 5.2 therefore carried out the necessary activities to facilitate the implementation and

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monitoring of the business cases and supported the PAs and CBs (NPA, LV, CAPO, OCS) in integrating the ENVISION products and services into their existing systems and ensured proper and efficient use of the products and services.

- Task 5.2 operated in parallel with Task 5.3, creating the most supportive and effective environment possible for the evaluation activities of Task 5.3.
- Outputs from this task, as a lesson learned from BC activities and from BC progress, supported the improvement of ENVISION's data products and services (WP3, WP4) and commercialisation and dissemination activities (WP6, WP7)

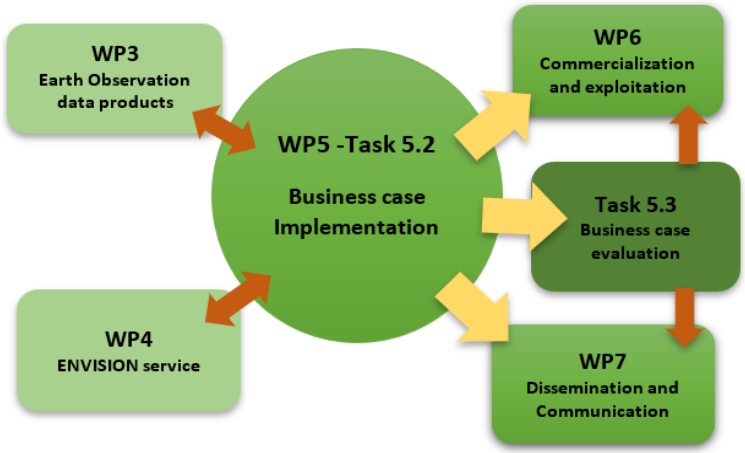

Figure 1 WP5 (Task 5.2) interactions

1.3 Time line and key activities of the BC implementation process

1.3.1 Key project activities prior to the BC implementation process

Prior to the BC implementation phase, the necessary activities were carried out from the beginning of the project (Figure 2 Timeline and key activities of the BC implementation processFigure 2), such as:

- The identification of PAs and CBs needs occurs in WP2 Commercial Service Requirements .
- Identify, collect and exploit all available ancillary datasets (Under Task3.2, for the details see D3.2 A catalogue on the available auxiliary data and repositories).
- Designing and developing the Envision platform (Within Task4.1, Task4.2, Task4,3, for more see D4.2 the initial version of the platform and D4.3 Integrated and validated version of the ENVISION platform).
- Developing the initial EO data products & services (Within Task3.3, Task3.4, Task 3.5, Task3.6, Task3.7), for the details, see D3.4 (Data products initial report).

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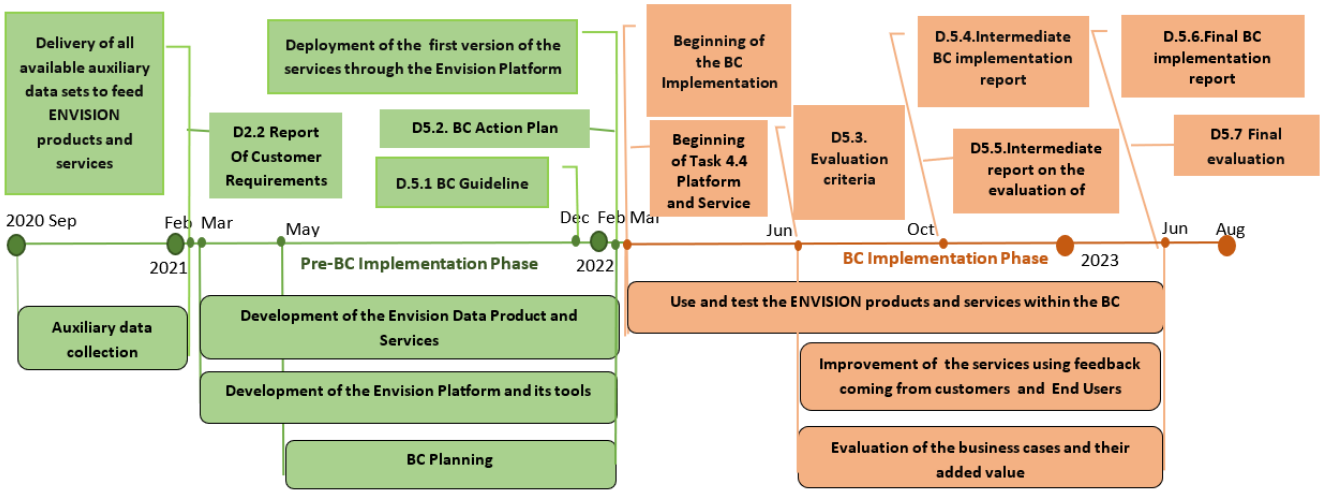

Figure 2 Timeline and key activities of the BC implementation process

In parallel with these activities, under WP5, BC planning was conducted to support the BC implementation phase.

1.3.2 Business case planning Steps

To support work related the BC planning all relevant activities from the beginning of the project has been followed as a way to understand and map in advance the business case actors, relations, needs, priorities and specific requirements, always in close collaboration with the Project Coordinator, WP2, WP3 and WP4 leaders.

Business Cases Planning consists of **two steps** to ensure the smooth uniform and successful implementation of all cases and it represents the keystone of the following tasks under the WP5 (see figure 3).

Development of BC guideline

The guideline is designed to be the reference point for the BC actors during the BC implementation phase. With the guideline, For each BCs, the roles of the actors (Table 18, Table 19) and the planned activities were defined, and these activities were assigned to each role. During the process, meetings were held for each BC with the BC actors to discuss and review the defined roles and their assigned activities. Furthermore, basic instructions and standard features and practices for efficient communication and coordination were created (see D5.1 BC guideline). BC guidelines were sfinalised in a close collaboration with BC actors, and project partners and with their collected feedbacks (M16).

Development of the Action Plans

The action plan was prepared in line with the general aim of the project and with the roles and activities established in the D5.1 guidance. The Action Plan has been developed in close collaboration with the Business case actors. Meetings were held for each BC customers to establish effective collaboration and integrate their specific perspectives, needs and objectives into the formulation of the BC Action Plan. The D5.2 BC Action Plan has been sfinalised with the integration of comments and suggestions from the PC and related project partners.

Developed BC Action Plan aims to collect detailed information about the execution of each BC. The content of the document acts as a road map for the implementation and will be used to monitor the progress of each BC.

BC Action Plan consist of 2 Chapter,

- BC Work Plan

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- ✓ BC Work plan is formulated in 2 phases (operational and evaluation Phase)
- ✓ Each Phase consists of activity group/s
- ✓ Each activity group is formed of several related activities

The BC work plan is structured so that it can be applied to all Business Cases and in an easy-to-follow manner. It provides information on the objectives and a short description of activity groups, information on the status of the activities and risks management. The General BC work plan is shown in Annex 5.3

- BC Gantt Chart (Annex 5.3)

- ✓ The BC Gantt Chart is created as a way to display activities against time
- ✓ It also presents milestones.

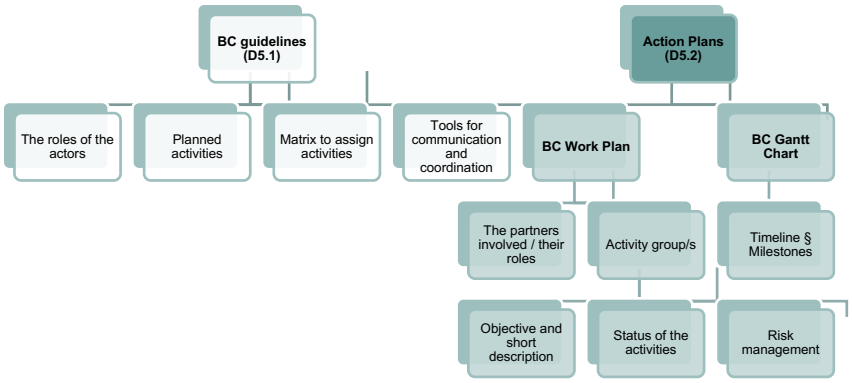

Figure 3 BC Planning Phase

1.3.3 BC Implementation phases

The BC implementation process began with the delivery of the first version of the developed data products to future customers (PAs and CBs) and was carried out in two phases (Figure 2). However, it is important to note that several key reports and activities originally planned for the months of June to August 2023 (Figure 2)., such as the final deliverables of WP5, were postponed due to the extended project timelines.

Operational Phase

During the operational phase, in accordance with the action plan, Envision data product and services were used and tested (PSC, EnU) under different conditions within the Business Cases. Each BC was continuously monitored and necessary feedback was collected (D5.4 Intermediate business case implementation report, D5.6 Final business case implementation report).

More spesifically, EV ILVO as Task leader, together with the task partners, performed the following monitoring, facilitation and supporting activities.

• Organized and facilitated the monthly regular BC progress meetings for each BC (in total 97 BC progress meetings). Meeting participants were all BC actors to ensure successful cooperation and communication. The primary goals of each meeting were:

- ✓ To record and monitor the implementation activities per BC based on the BC Action Plan, the BC Gantt Chart and BC milestones.
- ✓ To reveal issues like delays, new challenges, unforeseen risks etc., acting proactively and following a problem-solving approach, always in close collaboration with the project coordinator and the WP leaders. Regular updates took place at WP leader's monthly meetings and ad hoc meetings were organized when necessary.

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• Provision of support to the BC customers on various topics related to the implementation of the BCs like:

- ✓ Selection, definition and formatting of suitable and relevant data sets, related to the building, testing and validation of the Envision products and services.
- ✓ Selection of suitable accuracy levels and definition of an adequate service business logic.
- ✓ Access and use of the services through the Envision platform.
- ✓ Access and use of the Envision mobile app.
- ✓ Integration of the Envision services etc.

• Co-developed the BC progress reports together with the BC customers (see section 2).

• Development of Intermediate and Final BC Implementation Reports (see Section 2.3). The Final BC Implementation Reports, initially scheduled for delivery in June, has been rescheduled to October, owing to the project's extended timeline.

Evaluation Phase

For the evaluation phase, data products and results are continuously shared to discuss ways to meet the BC's needs and improve services. Developed Envision data products and services, were evaluated for each business case. The BC evaluation was carried out in parallel with the operational process. Questionnaires, interviews, and regular meetings with the BC actors were utilized as tools for the evaluation (D5.3 Evaluation criteria, D5.5 Intermediate report on the evaluation of services, D5.7 Final report on the evaluation of services).

More spesifically, EV ILVO as Task leader, together with the BC partners, performed the activities, which are summarized below.

- Methodology selection and tailoring to support evaluation criteria development and evaluation process (D5.3 Section 2).
- Elicitation & co-development workshop (Thessaloniki, May 5-6, 2022)
- Analysing the results and Consultation phase for feedback collection (D5.3 Section 4 and Section 5).
- Delivery of co-developed Evaluation Criteria.The co-developed evaluation criteria were presented for all BCs, including evaluation criteria for economic/technical and social impact with associated prioritised indicators, linked target groups and acceptance criteria based on focus group votes. (D5.3, Section 6 ,Tables5 to 11).
- Preparation for evaluation phase
  - ✓ Refining and enriching the evaluation criteria and indicators values (first and second evaluation round)
  - ✓ The data products were linked to the evaluation criteria for each BC (second evaluation round)
  - ✓ Development of questionnaires and templates (first and second evaluation round)
- Perform the evaluation (first and second evaluation round).
  - ✓ Data collection with templates, surveys and workshops
- The collected data was analysed and presented in the deliverable D5.5 (BC Intermediate Evaluation report) and D5.7 (Final BC Evaluation report)

1.4 BC Customers and their role in BC implementation Process

During the business cases implementation and evaluation, the ENVISION products and services were tested and validated by:

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- Business customers (ENVISION partners NPA, LV, CAPO, OCS) who are project partners and who were participated from the beginning of the project to its completion and
- Lighthouse Customers who are not members of the consortium and are participating in ENVISION voluntarily.

Two customer segments were involved in the project:

- Paying Agencies using ENVISION to monitor environmental and climate requirements of EU policies related to agriculture,
- Certification Bodies use ENVISION to monitor organic farming requirements.

And in addition;

- Farmers, through the mobile application
- Third parties (i.e. devs) through the Add-on development

Both PAs and CBs will ensure the demand-driven design of the project services and their value proposition and help pave the way for their market acceptance and uptake after the project.

1.5 Lighthouse customers and our approach

Lighthouse Customers have the option to choose the level and type of their involvement in the project during ENVISION's implementation and evaluation phases. Depending on their specific needs, each Lighthouse Customer will decide which ENVISION products and services they are interested in.

All Lighthouse Customers that are willing to participate in BC implementation and evaluation processes will act as BC Evaluators. They will contribute to further enhancing the results of the ENVISION project by providing extra information and feedback for the evaluation of Envision products and services through the workshops and/or demonstration events that will be provided.

Besides acting as a BC evaluator, they can also choose to participate in small-scale testing and evaluation of ENVISION's services by applying their chosen ENVISION services on their own data and small-scale testing area. This will create a new BC and according to that, the roles, responsibilities and assigned activities in the BC guideline will be integrated for each Lighthouse Customer Business Cases.

With this way for the case of the LightHouse Customers (LHC), the needed flexibility was created and conditions that allow fast entry and smooth deployment and evaluation of the data products and services.

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2 Approach & Methodology

2.1 Business Case Progress Report Template Creation

The goal of the business case progress report template is to monitor and identify the current status of BC implementation, ongoing developments and achievements of Envision data products and services. In the process developed **BC work plan** in the "D5.2 Action Plan" used as a **business case progress report template.**

To create the BC work plan (**Error! Reference source not found.**):

- First, we defined our goals to create a well-structured, well-fitting, detailed, and quality work plan. It followed the development of a specific, measurable, achievable, relevant, and time-bound Method.
  - Activities developed in the D5.1 BC Guideline were ranked in order of priority; where necessary, activities were grouped to keep them manageable and easier to understand and implement.
  - The activities were assigned to the relevant actors in accordance with the D5.1 BC Guideline.
  - Deadlines were set for each activity, and milestones were indicated (refer to the Gantt chart and milestones in Annex 5.3).
- The first draft of the work plan was shared with the Business case Facilitator (BCF) to establish effective collaboration among the BC actors and integrate their specific approaches, perspectives, needs and objectives into the formulation of the BC Action Plan.
- The renewed version of the work plan was shared with the project coordinator, WP leaders and the related project partners to gather their valuable inputs, comments, and suggestions for the BC action plan improvement.
- And finally, the final version was created in line with the collected feedback.

2.2 Methodology For Filling In The Business Case Progress Report Template

We created a template of the BC progress report where BC facilitators can provide descriptions and characteristics of their BCs. For an accurate description of each BC case, we have developed a section that covers general, but at the same time very specific, characteristics of each Business cases such as BC description, implementation area, what services (i.e. cultivated crop type maps, soil organic carbon, organic farming, grassland/ mowing ploughing, soil erosion) will be used, BCF contact information, partners involved with their roles.

The following section contains the details of the BC work plan. It is structured in an intuitive and easy-to-follow manner. It lists activities under activity groups and activity groups under two categories (operational phase and evaluation phase). It includes information on the objective and a brief description of activity groups where BC facilitators can provide information on the status of the activity and risk management. The General BC work plan description is shown in Table 6.

Feedback collection

It is important to mention that during the implementation of the BC, feedback was collected to monitor the BC's progress and evaluate the Envision data product and services. Feedback collection was carried out through meetings, workshops, events, questionnaires, and periodic reporting. The BCF should provide information on the name of the feedback reports, in conjunction with the number of the activity previously identified in the BC Work Plan, and should also describe the nature of each collected feedback and define the deadline. For the description of the nature, the following options should be used: R - document, report; DEM - demonstration; MW- meetings, webinars and workshops, S-surveys.

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Feedback Reports No.	Feedback Report Title	Activity No.	Nature	Due Date (DD/MM/YYYY)	Comments
	(e.g. progress report, survey)	(e.g. A 31, A35	(e.g. R, DEM)		

Table 1. Feedback Reports template

BC Milestones in the reporting period

In the action plan, Apart from the project Gantt Chart and milestones, the BC Gantt Chart was created outlining the schedule for each activity and milestones were defined specific to the BC implementation and monitoring process. We indicated the milestones for the purpose of motivation and to ensure that we were on the right track. Milestones are the specific points within a BC implementation and will be used to measure the BC implementation progress (seeBC Work Plan (BC progress report template) Annex 5.3 Milestones). In BC Gantt chart (see Annex5.3 Gantt chart), they represent critical events such as;

- Key deliverables (BC MS1, BC MS3, BC MS5, BC MS6, BC MS7, BC MS9, BC M1S0)
- Delivery of Envision data products and Services (BC MS1, BC MS7).
- Meetings or events (BC MS2, BC MS4, BC MS8)

(E.g. BC MS1 is important for BCs to start implementation and testing phase).
Among the 10 BC Milestones identified, there are 3 MS that correspond with project milestones.

BC Milestone	Project (WP) Milestone	Mean of verifications
BC-MS1	MS3	The initial version of data products is delivered. (D3.4)
BC-MS5	MS7	Intermediate BC implementation report (D5.4)
BC-MS6	MS8	Intermediate report on the evaluation of services (D5.5)

Table 2: BC implementation MSs that correspond with project (WP) MSs

For the achieved milestones in the examined reporting period, BCF should provide a mean of verification, a clear statement of achievement (yes/no) and an achievement date.

Milestones No	Milestone Name	Achievement (yes/no)	Achievement Date	Mean of verifications
M1	Deployment of the first version of the services.	Yes	End of Feb	The initial version of data products is delivered. (D3.4)
M2	BC level meetings, workshops and technical support.	Yes	End of May	Regular meetings, workshops and technical support organised.

Table 3. Business Cases Milestones Template

Provided Data/Information In The Reporting Period

During the BC implementation process, BC customers provided the necessary information and data to support and feed the Envision data product and services. For the gathered data in the reporting period, we collected information on data gathered through the table below.

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Short description of Data/information	Focused Crop type	Focused Area (location/size)	Data-format	Related data product/s	Related activity	Purpose of the data/information provided
Please descripe the data and /or information provided in this reporting peroid	(e.g. wheat, barley)	(e.g. National, name and size of the area)	(e.g. shape file, excel)	(e.g crop type map)	(e.g A11)	please indicate the purpose of the data

Table 4. Provided Data/Information In The Reporting Period

2.3 Development of Final business case implementation report

The content of each BC implementation report(D5.4 Intermediate Business Case Implementation Report, D5.6 Final Business Case Implementation Report) consists of several sub-progress reports co-developed under WP5. Information on the planned sub-progress report is given in Table 6.

Progress Reports.	Nature	Due Date (DD/MM/YYYY)	Achievement (yes/ no)
1 Progress report	Report	30/04/2022	yes
2 Progress report	Report	30/09/2022	yes
3 Progress report	Report	31/01/2023	yes
4 Progress report	Report	31/05/2023	yes

Table 5. Sub-Progress reports

From the start of the BC implementation to the project's end, it has been planned to collect 4 BC progress reports for each BC (in total 20 Reports covering the period from M19-M34), which are presented in this deliverable. The final business case implementation report was prepared in 6 steps:

- The BC progress report template (BC Work Plan) was developed and distributed to be filled in.
- The BC customers write the sub-progress reports using a standard pre-filled template provided by the task leader. This action was undertaken 4 times during the BC implementation phase (period from March 2022 and May 2023).
- After the reports were collected and reviewed by the task leader, feedback and comments were provided for finalisation. This action was undertaken 4 times during BC implementation phase (March 2022 and May 2023).
- Finalised BC sub-progress reports were analysed, and information collected through regular meetings and e-mails was presented in the draft deliverable.
- The first draft of the deliverable was shared with the Business case actors and project partners to integrate their comments and suggestions for finalisation.
- Lastly, the final version of the final business case implementation report was created.

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Business Case: *Code*	*Title*		
Business Customer:	*Potential future customers of Envision services,* *-Paying Agencies using ENVISION to monitor environmental and climate requirements of EU policies related to agriculture* *-Certification Bodies using ENVISION to monitor organic farming requirements*	***email:***	
Business case Facilitator	*Person responsible for supporting communication and collaboration*	***email:***	
BC Description	*Short Description of the BC*		
Specific objectives	*Brief explanation of BC objectives*		
Implementation area	*The spatial coverage of the products (National, Regional, local) within pilot sites.*		
Data Products	*Data products that will be tested and validated in BC by PSC*		
Service	*Services developed as a part of Data Product*		
BC Partners	***Short name of the Partners involved in BC Work Plan***	***Short Name***	***Short Name***
Partners Role	*Partners roles as those defined in D 5.1*		

Work Plan						
Operational Phase	**Activity Group 1** **Title of the activity group**	**Objective**	*Short description of the specific objectives which this Activity group aims to achieve.*				
		Short description	*Short description of activity groups; Describe the specific steps or actions that will take place to achieve the objectives of this activity group*				
		Activities	***Partners involved***	***Milestones***	***Status of Execution- performed work / Changes, Achievements and Improvements***	***Adverse developments during the execution, challenges / Potential Risks***	***Suggestions for solutions/ Risk mitigation***
		Name of the activity	*Partners involved in this particular activity*		*A brief overview of the status of the activity group; provide updates and an assessment of the progress of activities against the work plan: Are activities running ahead or behind schedule?*	*Describe during the implementation phase any major issues that have arisen or might be arisen during the progress: possible critical risks, uncertainties, and difficulties associated with the execution of the activities*	*Describe your proposed measures/strategy/ actions for addressing them to ensure a smooth implementation process.*

Table 6. Provided description (italic) of Business Cases Work Plan Template

3 Business Cases and Implementation reports

For each Business Case, implementation reports have been created based on the 4 BC progress reports, regular meetings and e-mails. This report summarises the progress and activities for each BC until the end of October 2023.

3.1 Cypriot Business Case

Generic Information of Business case

Cypriot Business Case					
Business Customer:	CAPO - Cyprus Agricultural Payments Organization	***Type of organisation:***	Paying Agency (PA)		
Business case Facilitator	George Groutas George Farkonis				
BC Description:	Short Description: This Business case evolves around using ENVISION products and services to the full population of FOIs (Feature Of Interest) declared, exploring their efficiency in monitoring farming activities undertaken in the context of CAP (Common Agricultural Policy).				
Implementation area	National scale				
Data Products	***Services***				
DP1: Analytics on Vegetation and Soil Index Time-series	Stubble burning identification on arable land				
	Detection of illegal land clearing in Natura2000 protection areas				
	Minimum soil cover for soil erosion				
	Runoff risk assessment for the reduction of water pollution in nitrate vulnerable areas,				
DP2: Cultivated crop type maps	Confirmation of GSAA				
	Smart sampling for OTSC inspections				
	Crops diversification compliance				
BC Partners	***EV-ILVO***	***CAPO***	***DRXS***	***NOA***	***FARMERS***
Partners Role	WPL	BCF	PP	SP	EnU
		PSC	BCE	BCE	BCE
		DP			
		EnU			
		BCE			

Table 7. Generic information of the Cypriot BC

The inspection of Cross Compliance, Greening, and RDP's (Rural Development Programme) climate-environmental requirements, including "Agri-environment and climate", "Organic farming" and "Natura 2000 and water framework directive payments", is currently a challenge to PAs because they consist of many different rules with different inspection dates. These requirements necessitate actions such as the verification of 1. crop types, 2. land abandonment, 3. use or not of herbicides, or mechanical weed control. The option to monitor the requirements remotely will reduce control costs for PAs and the administrative burden on farmers, thus ensuring faster and more efficient controls and faster delivery of payments to farmers.

Currently, the environmental and climate requirements are controlled by on-farm visits and visual inspections. The large number of different cross-compliance requirements and the environmentally friendly agricultural practices requirements under the RDP that have to be checked, coupled with the fact that they need to be inspected on different dates and/or apply to specific farmers significantly hinders the work of PAs.

CAPO uses a traditional method of monitoring and inspecting farmers' practices. This method consists of four steps: 1. submission of farmer's electronic application, 2. on-farm checks and some remotely sensed controls (using VHR (Very High Resolution) data that are very costly), 3. administrative controls, 4. submission of documents from farmers when required.

Through the ENVISION service, continuous and systematic remote monitoring of all of the above-mentioned requirements throughout the year. Moreover, simultaneously monitor different requirements, saving time and resources currently devoted to performing numerous on-farm checks to inspect multiple, different measures.

The ENVISION service can be used to provide warnings and information to farmers related to their declarations. Farmers will be involved through existing networks of the CAPO.

Cypriot BC focuses on employing ENVISION's services to monitor Cross-Compliance/Conditionality, and Strategic Plans Interventions regarding climate-environmental-requirements.

DP1: Analytics on Vegetation and Soil Index Time-series

Data Product Description:

Since the data from Sentinel are available and any combination of analytics or any index is possible to be derived, a toolset of analytics was pursued in Cyprus BC in order to address various eligibility conditions. So for example by using a combination of reduced moisture and absence of vegetation, together with values from soil index, the stumble burning identification service could be developed.

Stubble Burning Identification: Stubble burning is a practice used by farmers to avoid the cost of proper land management, negatively affecting the soil, biodiversity and the quality of air. This service helps identify parcels where stubble burning took place by utilising vegetation and soil indices. The results assist in controlling the relevant regulations and provide the means to raise awareness amongst farmers about the consequences of this practice. This contributes to the data product on an environmental aspect.

Minimum Soil Cover: The service for minimum soil cover detection evaluates the presence of adequate vegetation or soil cover on agricultural fields to prevent soil erosion and maintain soil health. It utilises vegetation and soil indices and focuses on critical time frames designated in the Cypriot CSP (CAP Strategic Plan) to assess whether both arable and permanent crop parcels comply with the minimum soil cover requirements. This service contributes to the data product by providing information to PAs regarding soil conservation practices and avoiding further soil degradation.

Runoff Risk Assessment for Water Pollution Reduction: This service assesses the risk of runoff causing water pollution in nitrate vulnerable areas (NVZ) by analysing vegetation and soil indices over time, specifically in areas adjacent to the hydrographic network of the country. The service contributes to the data product by helping the PA to promote sustainable farm practices, control high risk areas and protect the water quality in water bodies and aquifers.

Detection of illegal land clearing in Natura2000 protection areas: The service's purpose is to identify in Natura Areas, new farmland (cultivated land, bare soil, crop existence) by deduction of the current LPIS (Land Parcel Identification System). What remains is possible illegal clearing of land or land use conversion. It contributes to the data product by providing for PAs a continuous monitoring tool of sensitive areas and subsequently the ability to control and protect those areas.

Addressed problems and objections: Stubble Burning Control, Soil Erosion, Water Pollution Risk, Mismanagement of protected areas

Identified a product usage scenario (service business logic) and testing process

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From the beginning of BC implementation (March 2022), CAPO has identified a product usage scenario (service business logic) for the continuous assessment and testing of services. In this scenario,

- CAPO will assess to what extent the developed services and products can contribute to a better control framework for submitted applications and speed up the process of application checks and payments by saving time and resources.
- The business flow is to receive results from the services, aimed at monitoring the environmental and climate requirements of the Interventions of the National Strategic Plan.

Validation process after receiving the results:

  - Results are imported in CAPO's system, where both VHR and sentinel photos are available for the designated period.
  - CAPO analyzes the capability of the service to distinguish real cases from false positives, checks them against available validation data (ie VHR photos, OTSC results) and determines the level of precision.
  - Feedback is generated according to the validation results for improvement.
  - Final aim of CAPO is to notify the applicants of the findings from this service, so they proceed to corrective actions, or provide necessary documents.
  - Results can be forwarded to appropriate departments to take it into consideration in the AMS.

- For this BC, product coverage is National

DP2: Cultivated crop type maps (CCTM)

Data Product Description:

Cultivated Crop Type Maps data product is a comprehensive tool for accurately identifying and mapping the types of crops cultivated on agricultural land. Based on the farmer's declarations an array of results is produced to help identify false declarations, compliance with various rules or minimum requirements for interventions with the final aim being to alert farmers about them, and wait for their amendments. Almost every area based Intervention of the Strategic Plan includes the identification of the crop in a parcel as an eligibility condition. This makes it a core product in the framework of the AMS.

Confirmation of GSAA: This service plays a crucial role in verifying compliance with GSAA regulations. Not only ensures the alignment of declared and actual cultivated crops, it also generates a number of alerts ready to be communicated to farmers about compliance with regulations and requirements arising from the SP. It contributes to the data product by increasing the accuracy of the declarations by farmers which leads to even higher accuracy and altogether increased compliance.

Addressed problems and objections: Declared Crop Type Monitoring

Identified a product usage scenario (service business logic) and testing process

- CAPO will assess to what extent the developed services and products can contribute to a better control framework for submitted applications and speed up the process of application checks and payments by saving time and resources.
- The business flow is to receive results from the services, aimed at monitoring the environmental and climate requirements of the Interventions of the National Strategic Plan.
- For the validation process
  - Results are received in the format of shapefiles via email or cloud services.
  - Results are imported in CAPO's system, where both VHR and sentinel photos are available for the designated period.

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- CAPO analyzes the capability of the service to distinguish real cases from false positives, checks them against available validation data (ie VHR photos, OTSC results) and determines the level of precision.
- Feedback is generated according to the validation results for improvement.
- Final aim of CAPO is to notify the applicants of the findings from this service, so they proceed to corrective actions, or provide necessary documents.
- Results can be forwarded to appropriate departments to take it into consideration in the AMS.

Progress on Implementation Phase

- Since 01/03/2022, four Progress Reports were submitted: (April 30th 2022, September 30th, 2022, January 31st 2023, May 31st, 2023)
- During the different steps of the implementation process, all BC partners worked in close collaboration.
  - Until now, 20 BC meetings have been held with all BC actors and the minutes of the meeting have been prepared and distributed. In BC meetings, the current state of progress in BC, next steps, existing and/or potential roadblocks and solutions were discussed.
  - Beside the monthly BC meetings, additional meetings have been held whenever it is necessary for one of the partners.
  - Regular updates took place at WP leader's monthly meetings
- Technical support and instructions for data collection, use and testing of services were also provided together with the documentation produced by NOA:
  - Technical sessions took place as part of the progress meeting and extra technical meetings were organised where necessary. 7 extra meetings took place in addition to the BC progress meetings with NOA. and emails were sent when needed. These meetings have included:
    - Explanation of the algorithms,
    - Feedback sharing on validated results
    - demonstration of the services and give instructions on how to use them (regarding the DataCube API- Application Programming Interface), as well as discussion about the format of the results.)
- During the process data and results are continuously exchanged to discuss ways to meet BC's needs and improve services.
  - CAPO provided necessary information and data to support and feed the ENVISION data product and services, such as; Validation Data, Declarations Dataset 2022-2023 to run the services for current claim year and perform a final validation (see Table 17).

Short description of Data/information	Focused Crop type	Focused area (location-size)	Data-format	Related data product/s	Related activity	Purpose of the data/information provided
Greenhouse Dataset	Vegetables in Greenhouses	National	Shapefile	CCTM	A11	To refine the results when a crop is grown under plastic greenhouses.
Interim Declarations 2022	All	National	Shapefile	CCTM	A11	Further training of algorithms and to be used as the

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						source for a new iteration of the service.
River Network/Waterbodies	All	Buffers around River Network/Waterbodies	Shapefile	Runoff Risk	A11	Limit the area where needed for the service
Nitrosensitive Zone Areas	All	Nitrosensitive Areas	Shapefile	Runoff Risk	A11	Limit the area where needed for the service
Elevation Data for Slope Calculation	All	DEM 5m	Shapefile	Runoff Risk	A11	Limit the area where needed for the service
On the spot observations (Validation Data)	All	National	Shapefile	CCTM	A11	To be used as validation dataset for the results of the service
Validation Data	All	National	Shapefile	CCTM	A11	Validate the results for the new algorithm.
Declarations Dataset 2023	All	National	Shapefile	All services	A11	Run the services for current claim year and perform a final validation.

Table 8. Cypriot BC Provided Data/information by Business case customer to the Services Provider M19-M36

- Updated and improved results of the ENVISION data products (National scale) have been delivered to CAPO during the declaration period, at the end of the final day allowed to add new plots and at the end of the cultivation season (July). The results were provided in shapefile format.
- The validated results of 2022 are as follows:
    - Stumble burning identification: Parcels identified by the service: 219
    - Natura Hotspot Detection: Area identified by the service in CY2022: 160ha
    - Crop type Mapping: Parcels evaluated by the service are 330K. Results have been provided both in standalone format and through the platform
    - Minimum Soil Cover: Parcels identified by the service: 1418
    - Run off risk assessment in NVZ: Parcels identified by the service as high risk: 1035
- CAPO has installed the mobile app and tested it.

Progress on Evaluation Phase

Validation of latest Product and Services;

- CAPO provided feedback to the NOA on the data product/ services results
    - Stumble burning identification:
        - Validation method: Optical interpretation of VHR/Sentinel 2 images and on spot check.
        - Validation Sample: 100%
        - Accuracy/Reliability: 98.6%
    - Natura Hotspot Detection: Area identified by the service in Claim Year(CY) 2022: 160ha
    - Crop type Mapping: Results have been provided both in standalone format and through the platform:

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- Issues were identified with LPIS structure (parcels with very few pixels to provide meaningful analysis)
- Validation method: Random selection chosen from areas where VHR imagery was available,
- 3% of plots checked by photo interpretation of VHR images
- Accuracy 82.9%: Misclassified parcels can be attributed to Cyprus particularities. Accuracy rises if we exclude certain problematic crops such as fallow land

  - Minimum Soil Cover:
    - Validation method: Optical interpretation of HR & VHR images and Sentinel 2 images
    - Validation Sample: 15%
    - Accuracy/Reliability: 96%
  - Run off risk assessment in NVZ:
    - Validation method: Optical interpretation of images and the hydrographic network layer
    - Validation Sample: 20%
    - Accuracy/Reliability: 100%

- Latest insights;
  - Verification of compliance with conditionality requirements can be achieved with a relatively high degree of accuracy.
- CAPO has tested Envision mobile app and provided feedback:
  - The app is tested with on field visits but we have requested more functionality like extra filtering and sorting of plots
  - Limitation of photos to be allowed only inside the relevant parcel (low position accuracy of mobile phones leads to rejection of photos).
    - Suggestion to add a buffer around the parcel to compensate for the low position accuracy.
- After co-develop the evaluation criteria and their indicators. The criteria and indicators have been refined and enriched by ILVO through consultation with all BC actors(BC MS3 (D5.3) The Evaluation criteria Developed).
- Defined criteria and indicators linked with relevant data product and services of the BC.
- CAPO participated in workshops, and performed questionnaire surveys to evaluate the Envision data products and services and its added business value.
  - For the intermediate evaluation, 2 workshop, and 2 questionnaire surveys (BC MS6 (D5.5) Intermediate report on the evaluation of services).
  - For The final evaluation, 1 worksop, and 2 questionnaire surveys (BC MS10 (D5.7) Final report on the evaluation of services).
- CAPO provided Impact Indicator Values (Baseline-Target-Estimated Values) for impact assessment of the Data Product/services (BC MS6, MS10 (D5.5, D5.7) Intermediate & Final report on the evaluation of services).

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- CAPO tested the ENVISION mobile application and platform, and provided feedback on the functionality, usability, visual appeal and also consistency of these products.
    - The mobile app was tested and found to be useful for the farmer on the field. Firstly the farmer can access all the plots of his application through the app. The app also shows the results of the Envision Services for each individual parcel. In case of a parcel marked as ineligible or inconclusive, the farmer can take a photo using the app to prove the eligibility of the plot.
    - The Envision platform was tested in parallel to the results validation process and was found to be a useful tool in presenting the results in a visual and comprehensive way. It's a very useful tool for farmers who can not only access their plots' details but also they can verify their eligibility for subsidies.
    - The app's and platform's actual usefulness depends on factors such as its simplified user interface, ease of use, and the quality of support and updates provided by the developers.
- To gather the necessary feedback and insights from farmers on the Envision mobile app and Envision services, a workshop has been organised. The workshop was headed by the University of Reading with participation of 40 farmers both physically, in CAPO premises and online via Zoom. All farmers downloaded the mobile app and a small demonstration ensued. The general feeling was positive.

  Although the data used during the workshop were those of 2022 and were part of a test dataset, farmers thought positively of the fact that they could take photos for every plot of their application and not just those with some kind of alert. Positive comments were also made about the responsiveness of the app, while at the same time suggestions from the user perspective were received. When asked about the app as a whole, if it would suit farmer's needs, the answers were all on the positive side. Of note also is the fact that almost all participants stated that they had not used any similar app before and despite having no experience they thought they could manage it easily.

Collected Feedbacks

During the implementation of the BC, it collected feedback for the Cypriot BC to monitor the progress of the BC and evaluate the Envision data product and services presented in the table below.

No.	Feedback Report Title	Related Activity No.	Nature	Due Date (DD/MM/YYYY)	Comments
1	Progress report	**A31** Reporting on the Business Cases progress	R	30/04/2022	
2	Progress report	**A31** Reporting on the Business Cases progress	R	30/09/2022	
3	Cyprus BC Progress report	**A31** Reporting on the Business Cases progress	R	31/01/2023	
4	Cyprus BC Progress report	**A31** Reporting on the Business Cases progress	R	31/05/2023	
5	Impact Indicator Values (Baseline-Target-Estimated Values)	**A38:** Provide the Baseline information, if needed	R, S	20/10/2022 10/10/2023	
6	Survey "Evaluation of the business value and acceptance"	**A35**: Provide input to the workshops, events and questionnaire surveys, A26: Providing feedback as we deal with B2C and B2B scenarios.	S	10/10/2022 10/10/2022	

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7	Survey "Evaluation of Performance, Usability And Effectiveness"	**A35:** Provide input to the workshops, events and questionnaire surveys	S	10/10/2022 10/10/2022	
8	20 BC progress meeting	**A27:** Periodically holding meetings and calls at the BC level and prepare and distribute BC level meeting agenda and minutes, **A35:** Provide input to the workshops, events and questionnaire surveys, A26: Providing feedback as we deal with B2C and B2B scenarios	MW	March 2022-October 2023	
9	4 BC Evaluation Workshop	**A37:** Define Evaluation criteria, **A35:** Provide input to the workshops, events and questionnaire surveys, **A26:** Providing feedback as we deal with B2C and B2B scenarios	MW	March 2022-October 2023	

Table 9. Cypriot BC Collected Feedbacks M19-36

For the description of the nature, the following options should be used: R - document, report;

DEM - demonstration; MW- meetings, webinars and workshops, S- surveys

Challenges/Risk and Mitigation

The main risks identified and difficulties faced by Cypriot BC are summarised in the table below, along with a brief explanation of how they were managed:

Declared relevant activity	Challenges/Risk	Solutions/Mitigation
A3: Developing the business flow (or business logic) within the BC	High percentage of false declarations has been identified. (~10%)	For the false declarations we going to present them as warnings in our pre-filled forms for the applicants to take corrective actions
A10: Test the services under various conditions	1. The mobile app is tested with on field visits but we have required more functionality like extra filtering and sorting of plots	1. Update on the app
Project Risk No:11	Features of the provided products and services are not perceived as useful by end users	ENVISION will use a co-production approach to develop its products and service, which will be tailored to the specific target groups in the pilot communities. The methodology will ensure that needs of all actors involved are taken into account and are reflected in the design of the platform and services. Interaction with prospective end-users will start in the beginning of the project, and will continue once the solution is provided through the evaluation activities.
A11: Validate the products and services	Crop type mapping: During validation phase, issues were identified with LPIS structure (parcels with very few pixels to provide meaningful analysis), with summer crops following main winter crop, with greenhouse presence, especially temporary ones, with false declarations by applicants and difficulties in distinguishing crops at the lowest level. False declarations seem to be critical in many aspects and must be addressed.	Crop type mapping: Discussion in technical sessions between CAPO and NOA where different approaches may be discussed and put to test. Communication of results to farmers to amend declarations. Homogeneity marker has been developed to assess each parcel. Schedule of Iterations for each service to account for most main crops and secondary crops.

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	The homogeneity of declared parcels (in terms of contained pixels) should be further explored. When second crops follow the main crop, there is the possibility of getting mixed results in later iterations of the service, due to alterations in parcel statistics. Stumble burning identification: 1. A risk has been identified in cases where compost or livestock waste is applied in parcels as a means of soil improvement. 2. Specific parcels with high dNBR and a rare situation of smoke from an active fire mistaken for positive result. Natura Hotspot Detection: 1. Large Natura area (forest) leading to extended processing time for the service (pixel level) Minimum Soil Cover: Permanent Grasslands were identified as positive results. Mobile App: Limitation of photos to be allowed only inside the relevant parcel (low position accuracy of mobile phones leads to rejection of photos).	Use of higher resolution multispectral images (eg PLANET). Stumble burning identification: 1&2. Discussion will be held about ways to distinguish actually burned areas from burn-like areas. Natura Hotspot Detection: Limit the area at a buffer around the borders of those areas to identify the most probable clearings. Minimum Soil Cover: Exclude it from processing as the type of Permanent Grassland (PG) in Cyprus has characteristics like sparse vegetation, rocky ground and low quality soil which can easily mistaken for positive result. Mobile App: Suggestion to add a buffer around the parcel to compensate for the low position accuracy.
A38: Provide the Baseline information, if needed	For some Indicators, CAPO has difficulties in providing baseline data, such as difficulties in quantifying some elements regarding farmer declaration mistakes and frauds.	Analysis of the claims data on our disposal and identify the dividing line between mistake and fraud.

Table 10. Cypriot BC Challenges/Risk and Mitigation

Analyzed Challenges and Lessons Learned

Technical

- Envision services' results are valuable for the PA, especially as CAPO is currently developing algorithms for crop classification and other checks.
- Declarations drawn by farmers in GSA often do not follow the LPIS , due to temporary changes in land use or land utilisation, leading to difficulties in processing with ENVISION services. Declarations data must be cleared and processed before any service is executed.
- Classifying declared parcels presents challenges, such as small parcels, elongated geometries, and multipart polygons. Utilizing higher-resolution images is a potential solution for these cases.
- The climatic conditions in Cyprus lead to a single growing period for most crops, which coincides with the presence of natural vegetation, posing an additional challenge for classification.
- Verification of compliance with conditionality requirements can be achieved with a relatively high degree of accuracy.
- CAPO relies on in-house developed systems and database structures both for user interfaces and data storage and handling. To integrate the products for operational use, CAPO would have to optimize the data and proceed to transformations which will align it with the existing systems. A cost/benefit analysis may also be required to show if a system redesign is viable.

Organizational

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- Lack of previous engagement with earth observation hindered CAPO's ability to produce a full suite of required services. Late implementation of Checks by Monitoring-CbM (2022) did not allow for challenges to be identified earlier and be better addressed.
- CAPO's budget is prepared at least 6 months before every new year and has to undergo vigorous scrutiny from the Ministry of Agriculture, Ministry of Finance, as well as the General Government whose priorities are often different from CAPO needs.
- National and EU law require a public procurement process to be followed and by estimate of the total amount the process would be EU wide. Such processes may end up with a completely different contractor not guaranteeing the use of ENVISION products.
- Farmers should begin making declarations as early as possible to ensure the meaningful utilization of the results. Due to missing target dates set for the completion of Payments of the previous years applications it's not always possible to bring the declaration date forward.

Result

ID	Data Product	Services	Input / Output	Integration	Risks
DP1	Analytics on Vegetation and Soil Index Time-series	Stubble burning identification on arable land	**Input**: Declaration Dataset **Output**: Burned Parcels	• It directly relates to the GAEC03 requirements • The farmer is alerted through the GSA/AMS	• False positive results • Inability to produce documents from other authorities (ie Fire Department) • Farmer fails to amend his declaration
		Detection of illegal land clearing in Natura2000 protection areas	**Input**: Declarations limited to designated Natura areas and LPIS Dataset **Output**: Newly Cultivated Land	• It directly relates to the SMR2 requirements • The farmer is alerted through the GSA/AMS • Findings are communicated to the Environmental Authority	• Longstanding farmland which was not previously declared to be considered illegal. • Farmer fails to comply
		Minimum soil cover for soil erosion	**Input**: Declarations Dataset and Digital Elevation Model **Output**: Parcels with slope exceeding 10% with risk classification.	• It directly relates to the GAEC06 requirements • The farmer is alerted through the GSA/AMS • The OTSC department is alerted	• Multi – terraced parcels to be identified as high risk. • Abandonment of Parcels with high risk to avoid Conditionality penalties. • Farmer fails to comply
		Runoff risk ıssessment for ıe reduction of ıter pollution in ırate vulnerable areas	**Input**: NVZ Dataset/Hydrographic Network/Declarations. **Output**: Risk Classification at parcel level	• It directly relates to the GAEC06 requirements • The farmer is alerted through the GSA/AMS • Informative Letter to farmers about NVZ and their obligations.	• Hydrographic Network dataset is not maintained on a yearly basis, thus containing waterways which are not valid anymore, either due to changes in landscape, redirection of waterway etc. • Farmer fails to comply
DP2	Cultivated crop type maps	Confirmation of GSA	**Input**: Declarations dataset **Output**: Crop classification (traffic light)/Homogeneity	• Alerting Mechanism of GSA/AMS • Request for Geotag Photos	• Wrong Classification leads to administrative burden for farmers. • Misclassification due to severe climatic conditions during the growing period. • Disagreements with farmers especially on borderline cases

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					• Farmer fails to amend his declaration
		Smart mpling for OTSC inspections	N/A	N/A	N/A
		Crops diversification compliance	N/A	N/A	N/A

Table 11. Input/output, integration and potential risks of the Cypriot BC data products and services

Milestones

The milestones that have been achieved for the Cypriot BC are shown in the table below.

Milestones No	Milestone Name	Achievement (yes/no)	Achievement Date	Mean of verifications
BC M1	Deployment of the first version of the services.	Yes	End of Feb	The initial version of data products is delivered. (D3.4)
BC M2	BC level meetings, workshops and technical support.	Yes	End of May	Regular meetings, workshops and technical support organised.
BC M3	Define Evaluation criteria	Yes	End of Jun	The Evaluation criteria Developed (D5.3)
BC M4	BC level meetings, workshops and technical support.	Yes	End of Sep	Regular meetings, workshops and technical support organised
BC M5	Intermediate business case implementation report	Yes	End of-Oct	Intermediate business Case implementation report (D5.4)
BC M6	Intermediate evaluation report.	Yes	End of Oct	Intermediate report on the evaluation of services (D5.5)
BC M7	Delivering improved Envision Data product and Services though the platform.	Yes	End of Dec	The improved Envision of Data product and Services delivered.
BC M8	BC level meetings, workshops and technical support.	Yes	End of May 2023	Regular meetings, workshops and technical support organised
BC M9	Final business case implementation report	Yes	End of October 2023	Final business case implementation report (D5.6)
BC M10	Final evaluation report	Yes	End of October2023	Final report on the evaluation of services (D5.7)

Table 12. Cypriot BC Milestones

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3.2 Lithuanian Business Case

Generic Information of Business case

Lithuanian Business Case					
Business Customer:	NPA	***Type of organisation:***	Paying Agency (PA)		
Business case Facilitator	Aušrius Kučinskas, Martynas Rimgaila, Liveta Stankutė				
BC Description:	This Business case focuses on employing ENVISION's services to monitor Cross-Compliance, Direct Payments and Rural Development Programs' (RDP's) AE-linked requirements.				
Implementation area	National scale				
Data Products	***Service***				
DP1: Analytics on Vegetation and Soil Index Time-series	Stubble burning identification on arable land,				
	Harvest events detection				
	Minimum soil cover for soil erosion				
	Runoff risk assessment for the reduction of water pollution in nitrate vulnerable areas,				
DP2: Cultivated crop type maps	Confirmation of GSAA,				
	Smart sampling for OTSC inspections,				
	Crops diversification compliance				
DP3: Grassland Mowing Events Detection	Grassland Activity Monitoring and Management				
BC Partners	***EV ILVO***	***NPA***	***DRXS***	***NOA***	***FARMERS***
Partners Role	WPL	BCF	PP	SP	EnU
		PSC	BCE	BCE	BCE
		DP			
		EnU			
		BCE			

Table 13. *Generic information of the Lithuanian BC*

The inspection of Cross Compliance, Direct Payments and RDP's AE-linked requirements, including "Agri-environment and climate", "Organic farming" and "Natura 2000 and water framework directive payments", is currently a challenge to PAs because they consist of many different rules with different inspection dates. These requirements necessitate actions such as the verification of 1. crop types, 2. land abandonment, 3. use or not of herbicides, or mechanical weed control. The option to monitor the requirements remotely will reduce control costs for PAs and the administrative burden on farmers, thus ensuring faster and more efficient controls and faster delivery of payments to farmers.

Currently, the environmental and climate requirements are controlled by on-farm visits and visual inspections. The large number of different cross compliance requirements and the environmentally friendly agricultural practices requirements under the RDP that have to be checked, coupled with the fact that they need to be inspected on different dates and/or apply to specific farmers significantly hinders the work of PAs.

NPA has shown an active interest in employing EO technologies for monitoring farmers' performance (e.g. participation in RECAP project), as well as other technologies apart from on-farm checks; for

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example, farmers have the option to provide evidence regarding their activities by using NPA's mobile app , i.e. geotagged photos with captured coordinates, direction, azimuth value, and date stamp. Through this app, 1. farmers can inform NPA about performed activities (e.g. grass mowing, grass removal, catch crop seeding, green fallow ploughing), and 2. all users, including citizens, can inform NPA about bad farming practices (e.g. grassland areas that are not mowed). NPA officers evaluate the data and decide if they will perform on-farm-checks.

Envisioned monitoring: Through the ENVISION service, continuous and systematic remote monitoring of all of the above-mentioned requirements throughout the year. Moreover, simultaneously monitor different requirements, saving time and resources currently devoted to performing numerous on-farm checks to inspect multiple, different measures.

The ENVISION service has been used to provide alerts and information to farmers related to their declarations. Farmers will be involved through existing networks of the NPA.

This Business case focuses on employing ENVISION's services to monitor Cross-Compliance, Direct Payments and Rural Development Programs' (RDP's) climate-environmental requirements.

DP1: Analytics on Vegetation and Soil Index Time-series

Data Product Description: The integrated "Analytics on Vegetation and Soil Index Time-series" data product offers a holistic approach to land and crop management, ensuring compliance with agricultural regulations, enhancing crop quality, and promoting sustainable and environmentally friendly practices. It contributes to the efficient and sustainable management of agricultural land, while also safeguarding the environment.

Harvest Events Detection: The service monitors and detects agricultural harvest events, providing insights into the timing and extent of crop harvesting. By analysing vegetation and soil indices over time, it identifies when harvest activities occur. It contributes to the data product by adding a temporal dimension to crop monitoring, helping PAs understand cropping patterns, and ensuring compliance with agricultural regulations.

Stubble Burning Identification: Stubble burning is a critical environmental concern, and this service helps identify instances of stubble burning by analysing vegetation and soil indices. By detecting areas where stubble burning may have taken place, the service assists in monitoring compliance with regulations that restrict or govern stubble burning. This contributes to the data product by adding an environmental compliance component.

Minimum Soil Cover: The service for minimum soil cover detection evaluates the presence of adequate vegetation or soil cover on agricultural fields to prevent soil erosion and maintain soil health. It analyses vegetation and soil indices over time to determine whether the land meets the minimum soil cover requirements. This service contributes to the data product by ensuring that PAs have access to information regarding soil conservation practices.

Runoff Risk Assessment for Water Pollution Reduction: This service assesses the risk of runoff causing water pollution in nitrate vulnerable areas by analysing vegetation and soil indices over time. It helps PAs identify areas where runoff may pose a risk to water quality. The service contributes to the data product by supporting environmental protection efforts and ensuring compliance with regulations related to water quality.

Addressed problems and objections: Crop Harvest Monitoring, Stubble Burning Control, Soil Erosion and Health, Water Pollution Risk.

Identified a product usage scenario (service business logic) and testing process

From the beginning of BC implementation (March 2022), OCS has **identified a product usage scenario (service business logic)** for the continuous assessment and testing of services.

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- This business case defines the use of ENVISION data product that monitor various farming-related rules such as GAEC03 requirement, which restricts stubble burning except in specified cases related to environmental protection such as by burning dry grass, reeds, straw, forestry and horticultural waste, GAEC06 which requires sowing or planting agricultural crops on black fallow until October 1 of each year, and GAEC4 requirement who focuses on safeguarding water bodies, preventing pollution from agricultural activities and promoting responsible land stewardship within the broader context of the CAP SP. Using EO technology, the principle of lowest cost with the maximum effect is applying.
- The **main objective** is to implement an automatic requirements assessment system in agricultural and environmental contexts that would help ensure adherence to sustainable land management practices.
- To make the testing process smooth, NPA has provided a schedule of the services (algorithms) they would like to receive. The services that would achieve the required level of accuracy and reliability would be used during their inspection season and would replace traditional on-the-spot checks. The accuracy of the algorithms is calculated according to JRC recommendations, which state that quality control must link the real situation in the area to the results of the remote sensing data product. This process consists of several parts:
    - First of all, in-situ data is randomly collected by NPA according to certain criteria based on JRC guidelines:
        - Fields declared for the current year;
        - An area of not less than 0.1 ha;
        - Correct geometric configurations (proportional aspect width to length ratio);
        - The current year's remote view clearly shows one crop / land cover in the field (homogeneous land cover);
        - Located in different regions of the Republic of Lithuania;
        - And others.
    - The process of validating the services relied on the predetermined alerts time-periods outlined by the NOA. The central point of attention was to confirm if the timeframes mentioned in NOA signals accurately matched the actual timing of activities like harvesting, planting agricultural crops on black fallow land or stubble burning. It was essential to confirm that the service's predictions aligned with what was really happening by examining the data from the Sentinel satellite imagery. Even if there was a difference of about a week or slightly more between the NOA alerts time-periods and the actual time of the activities, these cases were still recognized and considered valid.
    - In many cases, the accuracy and reliability are determined by estimating alpha (<5 %) and beta (<20 %) mistakes according to JRC guidelines. So basically, the results of the services are confirmed if the alpha error is not greater than 5 percent and the beta error is not greater than 20 percent. In rarer cases, the services cannot be evaluated according to the quality calculation methodology due to their different data structure, for example “Runoff Risk Assessment” or “Stubble Burning Identification” services, so NPA chose other validation methods such as:
        - Comparison with NPA layers (e.g., Soil Erosion + Water Protection Zones);
        - Comparison with data from other sources (e.g., Fire Department, etc.);
        - Data analysis.

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- If the results of the service are valid, NPA confirms the algorithm and uses the results throughout the inspection season.
- NPA receives data product results in shapefile and/or .csv format.

- For this BC, data product coverage is National.

DP2: Cultivated crop type maps

Data Product Description: The "Cultivated Crop Type Maps" data product is a comprehensive tool for accurately identifying and mapping the types of crops cultivated on agricultural land. This data product is a valuable resource to monitor and ensure compliance with crop-related regulations and land management practices, promoting crop diversification.

Confirmation of GSAA: This service plays a crucial role in verifying compliance with GSAA regulations. It ensures that the crop types declared in GSAA align with the actual crops cultivated in the fields. By comparing the declared crop types with the cultivated crop type maps, this service confirms that farmers are following the guidelines and accurately reporting their agricultural activities. It contributes to the data product by increasing the accuracy of the crop type information, which is essential for regulatory and compliance purposes.

Smart Sampling for OTSC Inspections: OTSC are a key component of compliance monitoring in the agricultural sector. The service leverages cultivated crop type maps and other data sources to intelligently select which land parcels should undergo inspections. This contributes to the data product by ensuring that inspections are targeted efficiently, reducing the burden on both farmers and PAs while maintaining effective oversight.

Crops Diversification Compliance: Compliance with crop diversification requirements is essential for promoting biodiversity and sustainable agricultural practices. This service compares cultivated crop type maps with diversification rules to identify instances where farmers may not be meeting diversification standards. It contributes to the data product by assisting PAs in monitoring compliance with these rules, promoting the use of diverse crop types, and ensuring that agriculture aligns with environmental and sustainability goals.

Addressed problems and objections: Declared Crop Type Monitoring, Inspection of Farmers' Declarations, Crops Diversification Compliance

Identified a product usage scenario (service business logic) and testing process

From the beginning of BC implementation (March 2022), OCS has identified a product usage scenario (service business logic) for the continuous assessment and testing of services.

- This business case defines the use of ENVISION data product that monitor various farming-related rules such as the Direct Payments scheme's requirement within the Strategic Plan that states it is essential for farmers to ensure that the declared crop is either physically present in the field until August 1 of the current year or that there are clear remains of the declared crop, demonstrating that the field was indeed cultivated with the crop declared in the application. Using EO technology, the principle of lowest cost with the maximum effect is applying.
- The **main objective** is to implement an automatic requirements assessment system in sustainable agricultural practices associated with the respective crop types.
- To make the testing process smooth, NPA has provided a schedule of the services (algorithms) they would like to receive. The services that would achieve the required level of accuracy and reliability would be used during their inspection season and would replace traditional on-the-spot checks. The accuracy of the algorithms is calculated according to JRC recommendations, which state that quality control must link the real situation in the area to the results of the remote sensing data product. This process consists of several parts:

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- First of all, in-situ data is randomly collected by NPA according to certain criteria based on JRC guidelines:
  - Fields declared for the current year;
  - An area of not less than 0.1 ha;
  - Correct geometric configurations (proportional aspect width to length ratio);
  - The current year's remote view clearly shows one crop / land cover in the field (homogeneous land cover);
  - Located in different regions of the Republic of Lithuania;
  - And others.
- The process of validating the data involved looking at two key sources of information. Firstly, NPA examined the data collected during physical on-site inspections conducted in June. Secondly, NPA compared this real data with the most probable crop predictions generated by the ML model for the specified fields. Essentially, NPA was checking if the ML model's predictions matched up with the actual data gathered during on-site inspections to ensure their accuracy.
- The accuracy and reliability of the "Confirmation of GSAA" service was determined by estimating alpha (<5 %) and beta (<20 %) mistakes. So basically, the results of the algorithm are confirmed if the alpha error is not greater than 5 percent and the beta error is not greater than 20 percent. The reliability of each crop was calculated separately.
- If the results of the services are valid, NPA confirms the algorithm and uses the results throughout the inspection season.
- NPA receives data product results in shapefile and/or .csv format.

- For this BC, data product coverage is National.

DP3 Grassland mowing events detection

Data Product Description: The "Grasslands Mowing Events Detection" data product is designed to detect and monitor mowing activities in grasslands, meadows, and pastures. It automates the monitoring of mowing events, reducing the need for manual inspections and allowing for more efficient oversight.

Grassland Activity Monitoring and Management: This service enables the continuous monitoring of grassland mowing events to detect when mowing activities occur in grassland areas. It ensures that grasslands are managed effectively, mowing events are tracked, and compliance with regulations is maintained. By providing up-to-date information on grassland activities, the service contributes to the data product by enhancing its accuracy and timeliness, and by promoting responsible grassland management.

Addressed problems and objections: Grasslands Activity Control, Biodiversity Protection, Erosion Prevention

Identified a product usage scenario (service business logic) and testing process

From the beginning of BC implementation (March 2022), OCS has identified a product usage scenario (service business logic) for the continuous assessment and testing of services.

- This business case defines the use of ENVISION data product that monitor various farming-related rules such as the Direct Payments scheme's requirement, which defines that grasslands (classifier codes GPZ, DGP, DGA, DGI) and grassy nitrogen-accumulating plants on arable land (the codelist

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from third group of the classifier) must be mowed or grazed at least once a year no later than September 1 of the current year. Using EO technology, the principle of lowest cost with the maximum effect is applying.

- The **main objective** is to implement an automatic requirements assessment system in sustainable agricultural practices by ensuring that mowing activities align with environmental requirements and preventing potential damage to biodiversity and ecologically sensitive zones.
- To make the testing process smooth, NPA has provided a schedule of the services (algorithms) they would like to receive. The services that would achieve the required level of accuracy and reliability would be used during their inspection season and would replace traditional on-the-spot checks. The accuracy of the algorithms is calculated according to JRC recommendations, which state that quality control must link the real situation in the area to the results of the remote sensing data product. This process consists of several parts:
    - First of all, in-situ data is randomly collected by NPA according to certain criteria based on JRC guidelines:
        - Fields declared for the current year;
        - An area of not less than 0.1 ha;
        - Correct geometric configurations (proportional aspect width to length ratio);
        - The current year's remote view clearly shows one crop / land cover in the field (homogeneous land cover);
        - Located in different regions of the Republic of Lithuania;
        - And others.
    - The results of the in-situ mowing data were compared with the estimated alert timestamps indicating when the mowing event took place. NPA used Sentinel-2 imagery to examine each case and determine whether the timing indicated by NOA's mowing signals matched the actual period when mowing activities were detected.
    - The accuracy and reliability of this service was determined by estimating alpha (<5 %) and beta (<20 %) mistakes according to JRC guidelines. So basically, the results of the algorithm are confirmed if the alpha error is not greater than 5 percent and the beta error is not greater than 20 percent.
    - If the results of the service are valid, NPA confirms the algorithm and uses the results throughout the inspection season. After performing the validation process of this product and determining that the data is correct, NPA integrated these mowing results in its activities at the operational level in 2023.
    - NPA receives data product results in shapefile and/or .csv format.
- For this BC, data product coverage is National.

Progress on Implementation Phase

- Since 01/03/2022, four Progress Reports were submitted: (April 30th, 2022; September 30th, 2022; January 31st, 2023; May 31st, 2023)
- During the different steps of the implementation process, all BC partners worked in close collaboration.

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- Until now, 20 BC meetings have been held with all BC actors and the minutes of the meeting have been prepared and distributed. In BC meetings, the current state of progress in BC, next steps, existing and/or potential roadblocks and solutions were discussed.
- Beside the monthly BC meetings, additional meetings have been held whenever it is necessary for one of the partners.
- Regular updates took place at WP leader's monthly meetings

- Technical support and instructions for data collection, use and testing of services were also provided, together with the documentation produced by NOA.
  - Technical sessions took place as part of the progress meeting and extra technical meetings were organised where necessary. 2 extra meetings took place in parallel with BC progress meetings with NOA. Explanations are given, feedback is provided and emails are sent when needed. These meetings have included:
    - Explanation of the algorithms;
    - Feedback sharing;
    - Explanation of the way that NPA validates results;
    - Demonstration of the services and give instruction on how to use them;
    - Discussion about the format of the results.
- Moreover, data and results are continuously exchanged to discuss ways to meet BC's needs and improve services.
  - Constant cooperation and communication with NOA by exchanging the necessary data in order to test and validate the products and services provided, evaluate the quality of each algorithm, the accuracy of the generated results, identify nonconformities and perform a reanalysis of algorithm data.
- NPA provided necessary information and data to support and feed the ENVISION data product and services such as GSAA 2022 data uploaded to ENVISION portal, NPA algorithms accuracy calculation methodology based on JRC guidelines, time table of in-situ data collection and scheduled on-the-spot checks, list of layers that could be included in the platform (Erosion, Abandoned land area, Wetland area, Natura2000), time plan for ENVISION algorithms in 2022/2023, additional data to enhance the validity of the results such as 2020 inspection data, water protection zones, DEM (see table 3).
- NPA completed in-situ data collection in June 2022. This action is intended to collect data randomly but according to certain criteria selected parcels from different regions by their inspectors to evaluate the accuracy, productivity and performance of the algorithms. NPA used a quality calculation methodology based on JRC guidelines to determine the accuracy and reliability of the algorithms. The essence of quality calculation is closely associated to achieving acceptable levels of alpha and beta errors according to the recommendations defined by the JRC. The level of collected data automation is a critical factor in evaluating the productivity of the algorithms. Therefore, NPA analysed how the automation features of the algorithms simplify data quality assessment workflow and reduce manual intervention. Performance of the algorithms is evaluating by their data processing speed, so NPA assessed in each case how quickly a product quality calculation can be performed with the data provided by the algorithms.

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Short description of data/ information	Focused Crop type	Focused area (location-size)	Data-Format	Related data product/s	Related activity	Purpose of the data/information provided
Extra layers to the ENVISION portal: erosion, abandoned land area, wetland, Natura2000		All region	Shape file	2022 season ENVISION portal		Show extra layer in ENVISION portal as additional information together with generated results from algorithms (Crop type map, vegetation status, grassland mowing/ ploughing, soil erosion)
GSAA 2022 data uploaded to ENVISION portal	All crops	All region	Shape file	2022 season ENVISION portal		Show GSAA data in ENVISION portal
NPA algorithms accuracy calculation methodology based on JRC guidelines		All region	Methodology	Crop type map, vegetation status, grassland mowing/ ploughing, soil erosion	A11	Share methodology with technical team
Timetable of in-situ data collection and scheduled on-the-spot checks		All regin	Table	Crop type map, vegetation status, grassland mowing/ ploughing, soil erosion	A11	Share timetable with technical team to have a full picture of results validation
ENVISION products results delivery dates in 2022		All region	Table	Crop type map, vegetation status, grassland mowing/ ploughing, soil erosion		Have an agreement on results delivery dates
2020 inspection data	PDJ crop	All region	Shape file	Minimum Soil Cover		Provide 2020 inspection data shapefile with GAEC4 rule non-compliances to enhance the validity of the results
DEM		All region	Service link	Soil Erosion		Provide Digital Elevation Model (DEM) WMS service link to the technical team for use it on the second iteration of the algorithm
Water protection zones		All region	Shape file	Run-off risk assessment		Share the distance categories with the technical team to calculate the final product
Time plan for 2023 algorithms		All region	Table	Grasslands Mowing Event Detection, Cultivated Crop Type Maps, Stubble Burning Identification, Minimum Soil Cover, Nitrate Vulnerable Zones		Have an agreement on results delivery dates

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				(NVZ), Harvest event detection		
Data from the Fire Department		All region	.csv	Stubble Burning Identification		Provide the unique ID's of the 2022 burned fields in August to enhance the validity of the results

Table 14. Lithuanian BC Provided Data/information by Business case customer to the Services Provider M19-M36

- Updated and improved results of the ENVISION data products (National scale) have been delivered to the NPA:
  - The analysis of the results of each algorithm shows that the accuracy of the data reaches:
    - Grasslands Mowing Event Detection – 100%;
      - ➔ Delivery time in 2022: 1st iteration delivered in September 2022, 2nd iteration delivered in November 2022;
      - ➔ Delivery time in 2023: 1st iteration delivered in July 2023, 2nd iteration delivered in early August 2023 and 3rd iteration delivered at the end of August 2023;
      - ➔ Delivery format: shapefile/.csv.
    - Minimum Soil Cover – 98%;

      ➔Delivery time in 2022: 1st iteration delivered in December 2022 and 2nd iteration delivered in March 2023;

      ➔Delivery format: shapefile.
    - Harvest Event Detection – 96%;
      - ➔ Delivery time in 2022: 1st iteration delivered in November 2022, 2nd iteration delivered in December 2022;
      - ➔ Delivery time in 2023: 1st iteration delivered in July 2023, 2nd iteration delivered in early August 2023 and 3rd iteration delivered at the end of August 2023;
      - ➔ Delivery format: shapefile/.csv.
    - Cultivated Crop Type Maps (CCTM) – 97%;
      - ➔ Delivery time in 2022: 1st iteration delivered in July 2022, 2nd iteration delivered in September 2022 and 3rd iteration delivered in March 2023;
      - ➔ Delivery time in 2023: 1st iteration delivered in July 2023, 2nd iteration delivered in early August 2023 and 3rd iteration delivered at the end of August 2023;
      - ➔ Delivery format: shapefile/.csv.
    - Stubble Burning Identification – Confirmed;
      - ➔ Delivery time in 2022: data results delivered in October 2022;

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- ➔ Delivery time in 2023: 1st iteration delivered in early January 2023, 2nd iteration delivered at the end of January 2023 and 3rd iteration delivered in March 2023;
- ➔ Delivery format: shapefile/.csv.

- Runoff Risk Assessment – Confirmed;
  - ➔ Delivery time in 2023: data results delivered in February 2023;
  - ➔ Delivery format: shapefile.
- Soil Erosion – Confirmed.
  - ➔ Delivery time in 2022: data results delivered in December 2022;
  - ➔ Delivery format: shapefile.

- A total of 1 092 645 fields were imported into the ENVISION platform.
- NPA tested the ENVISION mobile application and platform to discover all the best features, possibilities, benefits and added value for users. To achieve this objective, it was necessary to test the functionality, usability, visual appeal and also consistency.

Progress on Evaluation Phase

Validation of latest Product and Services;

- NPA team tested several algorithms provided by NOA such as Minimum Soil Cover, Harvest Event Detection, Stubble Burning Identification, Runoff Risk Assessment and Soil Erosion; the validation process of these algorithms included verification of Sentinel-2 imagery, comparison with NPA layers (Soil Erosion + Water Protection Zones), comparison with data from other sources (Fire Department, etc.) and those data analysis.

Cultivated Crop Type Maps: Data validation took place with the set of in-situ data by comparing the results found during the on-site inspections in June and the most probable crop predictions according to the ML model in the declared field. A total of 18 crop types were analysed respectively, including spring cereals, winter cereals, fallows, pastures/meadows and other crops. Based on the results of the 3rd iteration, the algorithm successfully identified even 15 types of crops, which means that the accuracy of the data product in this case reached the highest level compared to other iterations. Only three cases were incorrectly identified, but the overall reliability of the algorithm remains relatively highly – even 97 percent.

N	Algorithm type	Reliability (%)	ALPHA+ BETA parcels	Alpha (%)	Beta (%)
1	Winter wheat	99%	128	0%	33%
2	Spring wheat	95%	153	**5%**	**0%**
3	Spring barley	98%	122	**2%**	**0%**
4	Oats	98%	129	**2%**	**#DIV/0!**
5	Winter rape	100%	143	**0%**	**0%**

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6	Peas	98%	133	**2%**	**0%**
7	Buckwheat	98%	132	**2%**	**0%**
8	Beans	100%	136	**0%**	**0%**
9	Black fallow	92%	122	5%	28%
10	Green fallow	95%	136	**5%**	**6%**
11	Perennial pastures or meadows 5 years and more	99%	142	**1%**	**0%**
12	Pasture or meadow, perennial grass up to 5 years	81%	121	4%	100%
13	Corn	99%	134	**1%**	**0%**
14	Spring rape	97%	137	**2%**	**6%**
15	Winter rye	98%	135	**2%**	**0%**
16	Winter barley	98%	144	**2%**	**0%**
17	Winter triticale	98%	124	**2%**	**0%**
18	Spring triticale	97%	135	**2%**	**17%**

Table 15. Lithuanian BC Cultivated Crop Type Maps validation results table, 2022

#DIV/0! – no parcels identified for Beta calculation

In accordance with EC Recommendation, the quality assessment of the results of the automatic field remote sensing system (ALNSIS) shall be performed using two types of statistical error:

1. Error [α] defines a false RED finding when the applicant has declared the fields in the ALNSIS negative. These errors may not account for more than 5% of the total results, i.e. less than 1 in 20 applicants would have grounds for appeal.
2. The [β] error defines a false GREEN finding when the applicant has incorrectly declared the fields and the ALNSIS result is positive. These errors may not account for more than 20% of the total results, i.e. only 1 in 10 or 1 in 5 ineligible applicants may remain undetected.

Grasslands Mowing Event Detection: The data product was validated with a random set of parcels larger than 0.5 HA. Each case was checked through Sentinel-2 imagery to see if the timeframe of mowing signals provided by NOA corresponded to the actual mowing detection time period. More than 100 such cases with established signs of the presence of animals in the field were checked manually. During the first iteration of the Grasslands Mowing Event Detection, the beta mistakes reached 100 percent, with a total of 2 nonconformities and the overall accuracy was 98 percent. These cases with discrepancies were analysed in detail and sent to NOA for further analysis. After that, NPA received the second iteration of the data product from NOA, performed a quality calculation and presented to partners much better accuracy results, they were reaching 100 percent without any alpha and beta mistakes.

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N	Algorithm type	Reliability (%)	ALPHA+ BETA parcels	Alpha (%)	Beta (%)
1	Grasslands Mowing Event Detection_1st iteration	98%	103	0%	100%
2	Grasslands Mowing Event Detection_2nd iteration	100%	101	**0%**	**#DIV/0!**

Table 16. Lithuanian BC Grasslands Mowing Event Detection validation results table, 2022

#DIV/0! – no parcels identified for Beta calculation

Harvest Event Detection: For the validation of the Harvest Detection algorithm results, 274 cases were randomly selected and checked through Sentinel-2 imagery. Selected parcels were larger than 0.5 HA. 77 cases were excluded from the quality calculation due to inhomogeneity and lack of images. So basically, a total of 197 cases were confirmed/not confirmed whose data was used to calculate the quality of this algorithm. The validation principle was identical to the late mowing, checking the dates of the signals provided by the NOA. During the first iteration, accuracy reached 98 percent, with 4 beta mistakes that were sent to partners for further analysis. NOA provided a second iteration of the results after analysing those mistakes, including some additional indices like PSRI and improving their cloud detection processes. The data from the second iteration reduced the beta percentage and improved the overall quality of the final results.

N	Algorithm type	Reliability (%)	ALPHA+ BETA parcels	Alpha (%)	Beta (%)
1	Harvest Detection_1st iteration	98%	197	0%	57%
2	Harvest Detection_2nd iteration	96%	197	**4%**	**5%**

Table 17. Lithuanian BC Harvest Detection validation results table, 2022

Minimum Soil Cover: NPA received the Minimum Soil Cover algorithm data from NOA on December 21, 2022. The data was checked by randomly selecting 105 parcels for quality calculation. All analysed cases are validated according to our on-site inspection results. Each case was checked through Sentinel-2 images to see when exactly the black fallow was sowed, the parcel comply/does not comply to the GAEC4 rule, or the alert data provided by the NOA between start and end monitoring dates (June to November) detects PDJ crop sowing. A quality calculation shows that the accuracy is only 66 percent, with 16 alpha and 20 beta mistakes. All these nonconformities have been sent to NOA for verification and to identify the factors related to the inaccurate data. Based on the comments received from partners on March 14, 2023, we re-evaluated the quality of the algorithm, which led to significantly better results than during the first version - the reliability reached 98 percent.

N	Algorithm type	Reliability (%)	ALPHA+ BETA parcels	Alpha (%)	Beta (%)
1	Minimum Soil Cover_1st iteration	66%	105	32%	36%
2	Minimum Soil Cover_2nd iteration	98%	82	**0%**	**5%**

Table 18. Lithuanian BC Minimum Soil Cover validation results

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Stubble Burning Detection: For the validation of the Stubble Burning Detection algorithm, NPA randomly selected a set of 50 parcels and checked it through Sentinel-2 imagery. NPA provided our comments to the NOA by summarising the fact that the data for all the cases analysed were incorrect - all parcels were not burnt. We also sent a Word document with several cases related to the fact that the data provided by the NOA said that the fields were burned, but we saw a completely different situation. Then NOA re-analysed those cases and concluded that their data were correct based on their photo interpretation. Finally, NPA double-checked two examples and were able to reconfirm that those parcels were not burned. Actually, they were ploughed in the same way as the surrounding agricultural fields. Also attached a document with examples of what stubble burning looks like in the summer. So basically, after receiving comments, examples and other necessary data, NOA additionally checked the burn area and the validity of Stubble Burning Detection product modifications. After that, two additional iterations of the results were sent to us to evaluate the performance and reliability of this data.

The most recent version of Stubble Burning Identification algorithm data was sent by NOA on March 29, 2023. This algorithm was validated by comparing the data provided by technical partners with the data from the Fire Department, etc., and by analysis, looking for cases where stubble was burned, but ENVISION did not provide any results for such fields. Fortunately, not many such cases were detected, so the algorithm can be confirmed

Soil Erosion: The results of the Soil Erosion algorithm sent by NOA on December 30, 2022, and on February 3, 2023 NPA received data from the Runoff Risk Assessment algorithm. For the validation of these algorithms, we chose a completely different method - comparison with NPA layers (Soil Erosion + Water Protection Zones), determining if the data correlate with each other. After the comparison, we identified that the algorithms work well, the provided data is clear and correct. Based on the results of the Soil Erosion algorithm, a map was prepared representing the areas of Lithuanian agricultural land affected by erosion at the municipal level.

- NPA has additionally tested ENVISION mobile application and platform, then provided feedback on the functionality, usability, visual appeal and also consistency of these products.
    - NPA found that the app has a great user interface, has the potential to run on any Android or iOS device as phones or tablets, has effective pixels and functions that really improve the quality of the system. Deploying the ENVISION web-based platform by maximising usability ensures the improvement of the end-user experience.
        - ➔ The Envision mobile application and platform seems to offer a comprehensive set of features that can benefit farmers and PAs by streamlining data management, improving decision-making, and enhancing the overall efficiency of agricultural operations. However, the app's and platform's actual usefulness depends on factors such as its simplified user interface, ease of use, and the quality of support and updates provided by the developers.
- NPA presented algorithm results and algorithm comparison between three sources (DIONE/ENVISION/ALNSIS). NPA provided to our partners a brief comparative overview of how each project's algorithm works, which satellite data they use, etc.
    - ➔ In principle, results from all three sources are basically usable in NPA activities, however only ALNSIS algorithms demonstrate the appropriate quality of all crops, etc. in the case of algorithms;
    - ➔ DIONE and ENVISION do not achieve the required quality in some cases, although, for example, ENVISION uses data from both Sentinel-1 and Sentinel-2 satellites, as well as ALNSIS. DIONE only uses Sentinel-2, but there is no obvious difference in results between DIONE and ENVISION;

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- ➔ In addition, the method of how the algorithms work is also different. For example, ALNSIS has to simply confirm/deny the specified crop in the declared field by comparing the data of all parcels declared with the same crop, while DIONE and ENVISION try to identify the most probable crop in the declared field from the entire set of crops;
- ➔ Another example, when determining whether a meadow is perennial, ALNSIS checks 5 years of data, while between DIONE and ENVISION there is only 1 year;
- ➔ Also important is how often algorithm results are provided to the agency. In the case of DIONE, they were submitted only once in early July, in the case of ENVISION in mid-July and early September, and in the case of ALNSIS, the results were submitted every 10 days from the end of June to the middle of August.

- After co-develop the evaluation criteria and their indicators. The criteria and indicators have been refined and enriched by ILVO through consultation with all BC actors (BC MS3 (D5.3)) The Evaluation criteria Developed).
- Defined criteria and indicators linked with relevant data product and services of the BC.
- NPA participated in workshops and performed questionnaire surveys to evaluate the Envision data products and services and its added business value.
    - For the intermediate evaluation, 2 workshops, and 2 questionnaire surveys (BC MS6 (D5.5)) Intermediate report on the evaluation of services).
    - For The final evaluation, 2 workshops to evaluate the Envision data products and services and its added business value (BC MS10 (D5.7)) Final report on the evaluation of services).
- NPA provided Impact Indicator Values (Baseline-Target-Estimated Values) for impact assessment of the Data Product/services (BC MS6, MS10 (D5.5, D5.7)) Intermediate&Final report on the evaluation of services).
- Baseline collected based on 2022 claim year statistical data or estimated based on common experience
- Farmers interested in technological innovations were invited to try out the ENVISION mobile application to contribute to its improvement (target value – 100 farmers; Farmer satisfaction measured through questionnaire survey 90% -Expected; Acceptance of the proposed services by farmers: 80%).
    - ➔ An invitation was sent to each farmer to download the Envision mobile application and test it at the same time for improvement purposes. Farmers also received the questionnaire surveys where they could express their opinion on the app's functionality and usability;
    - ➔ The investigation took place over a three-month period in 2023 (from the beginning of July to the end of September), in line with NPA monitoring requirements;
    - ➔ A total number of 109 sampled users (farmers) ranging in age from 35 to 65 years. The average age was 40,6 years.
    - ➔ The vast majority of randomly selected co-operators (farmers) were located in South-eastern part of Lithuania, the rest of the users can be found in the Western and Central parts of Lithuania;
    - ➔ Farmers in small-scale and large-scale farming mostly including commercial cropping and livestock keeping activities;
    - ➔ The high satisfaction rate (90 percent) indicates that the Envision mobile application aligns well with farmers' needs, provides valuable tools and offers a user-friendly and intuitive

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interface, making it easy for farmers, even those who may not be tech-savvy, to navigate and use the application without significant barriers. Farmers are finding it to be a practical and efficient tool for improving their farming and land management practices.

➔ The invitation to provide feedback through the questionnaire surveys demonstrates that the developers value farmers' input. Farmers appreciate being heard and having the opportunity to contribute to the app's improvement.

Collected Feedbacks

During the implementation of the BC, collected feedback for the Lithuanian BC to monitor the progress of the BC and evaluate the Envision data product and services presented in the table below.

No.	Feedback Report Title	Related Activity No.	Nature	Due Date (DD/MM/YYYY)	Comments
1	Progress report	**A31** Reporting on the Business Cases progress	R	30/04/2022	
2	Progress report	**A31** Reporting on the Business Cases progress	R	30/09/2022	
3	Progress report	**A31** Reporting on the Business Cases progress	R	31/01/2023	
4	Progress report	**A31** Reporting on the Business Cases progress	R	31/05/2023	
5	Impact Indicator Values (Baseline-Target-Estimated Values)	**A38:** Provide the Baseline information, if needed	R, S	20/10/2022 10/10/2023	
4	Survey "Evaluation of the business value and acceptance"	**A35**: Provide input to the workshops, events and questionnaire surveys, A26: Providing feedback as we deal with B2C and B2B scenarios.	S	13/10/2022 10/10/2022	
5	Survey "Evaluation of Performance, Usability and Effectiveness"	**A35:** Provide input to the workshops, events and questionnaire surveys	S	13/10/2022 10/10/2022	
6	Survey for challenges	**A35:** Provide input to the workshops, events and questionnaire surveys	S		
6	20 BC progress meeting	**A27:** Periodically holding meetings and calls at the BC level and prepare and distribute BC level meeting agenda and minutes, **A35:** Provide input to the workshops, events and questionnaire surveys, A26: Providing feedback as we deal with B2C and B2B scenarios	MW	March 2022-October 2023	
7	5 BC Evaluation Workshop	**A37:** Define Evaluation criteria, **A35:** Provide input to the workshops, events and questionnaire surveys, **A26:** Providing feedback as we deal with B2C and B2B scenarios	MW	March 2022-October 2023	

Table 19. Lithuanian BC Collected Feedbacks M19-M36

For the description of the nature, the following options should be used: R - document, report;

DEM - demonstration; MW- meetings, webinars and workshops, S- surveys

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Challenges/Risk and mitigation

The main risks identified and difficulties faced by Lithuanian BC are summarised in the table below, along with a brief explanation of how they were managed:

Declared relevant activity	Challenges/Risk	Solutions/Mitigation
A11: Validate the products and services	The most potential risk for crop type identification is that winter wheat, spring wheat, peas, black fallow, green fallow, pasture or meadow, perennial grass up to 5 years, sugar beet, spring rape and also winter triticale does not achieve the required level of accuracy.	In this case, the necessary support for algorithm adjustments and result improvements will be provided
A11: Validate the products and services	One of the challenges is closely associated to the validation of the "Runoff Risk Assessment" algorithm, since the data product was prepared on the basis of the Lithuanian water coastal protection belts layer, there was no clear method to check the accuracy of the algorithm, as the data were mutually correlated.	Collaboration with experts and the use of multiple data sources will help enhance the validation process and improve the reliability of the algorithm's predictions.
A11: Validate the products and services	Remote sensing data products may have some misclassifications related to lack of cloud-free images that can affect the accuracy of algorithm results.	Continuous collaboration with technical partners, feedback integration and improvement to enhance the productivity and performance of data products will address this risk.
A38: Provide the Baseline information, if needed	For some Indicators, NPA has difficulties in providing baseline data.	To facilitate the process, WPL developed a template that offers several options for the data sources and evaluation methods. So, baseline information that cannot be collected will be supplemented by expert judgement.

Table 20. Lithuanian BC Challenges/Risk and mitigation

Analysed Challenges and Lessons Learned

- Ensuring the accuracy and reliability of algorithm outputs is paramount, especially when the products data is used in the PAs control processes to monitor compliance with specific CAP rules based on Strategic Plans;
- The rapid resolution of challenges and risks is ensured by effective cooperation of technical partners and PAs in mutual pursuit of better data products quality;
    - ➔ By collaborating with technical experts and actively providing feedback, they can adapt new data parameters and enhance the effectiveness of algorithms in that way, such as by identifying the specific factors associated with the misclassifications.
- Involvement of domain experts, such as agronomists or environmental scientists, in the data products validation processes. Their expertise can provide valuable insights into validation methods and the calculation of reliability in algorithm outputs.

Steps for data product integration:

- A crucial requirement is to follow a public procurement process, which means obtaining the Envision product in a controlled and transparent way. This process guarantees that the purchase and utilisation of the Envision product aligns with the regulations and standards established by the NPA.

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- To prepare the data product for operational use, there is no requirement for altering or adjusting existing regulations or rules.
- To get the data product ready for operational use, the essential requirement is to have a specific type of file, known as a shapefile, which contains attribute data similar to what we obtained during the Envision project.

Latest insights and findings are;

- ENVISION products and services create significant added value in implementing CAP needs:
  - Prevention of sanctions (the results of the algorithms are shown to applicants);
  - Reduced workload of field inspectors;
  - Lower number of on-site inspections;
  - Noticeable cost savings in an economic context;
  - Effective crop management at the farm level.
- The increased efficiency through automated data processing can lead to quicker decision-making and reduced administrative workload;
- Envision data products can be configured to provide early alerts when specific events are detected. This enables proactive responses and helps prevent operational issues;
- The accuracy of the algorithms results reaches a noticeably high percentage, which means that the products developed by NOA work very well without any complaints;
- PAs have a high probability of using these algorithms at the operational level for checking the implementation of requirements.

Result

The "Analytics on Vegetation and Soil Index Time-series" data product leverages time-series data related to vegetation and soil indices to provide analytical insights and decision support for agricultural and environmental applications. It aids in monitoring, analysing, and improving the health and productivity of crops and the land they are grown on. The "**Harvest Events Detection**" service provides end-users with a valuable tool for monitoring and detecting harvest events in agricultural areas. It offers insights into when crops are harvested, allowing end-users to track agricultural activities, plan resource allocation, and ensure compliance with agricultural regulations. The inputs for the "Harvest Events Detection" service typically include satellite imagery capturing the target agricultural areas, geospatial data to determine the location of agricultural fields and vegetation indices. NPA provided GSAA 2022/2023 datasets for the development of this service. The algorithm provides accurate timestamps for harvest events, allowing end-users to precisely track when crops are harvested. End-users receive information about the specific fields where harvest events occur, helping with field-level monitoring. So basically, the service assists in ensuring compliance with agricultural regulations related to planting and harvesting deadlines. The "**Stubble Burning Identification**" algorithm delivers a crucial service to end-users, primarily focusing on detecting and monitoring instances of stubble burning in agricultural fields. It is useful in agricultural practice because it supports compliance with environmental regulations, promotes responsible crop residue management, and contributes to longstanding environmental sustainability strategy. It directly relates to the GAEC03 requirement, which restricts stubble burning except in specified cases related to environmental protection such as by burning dry grass, reeds, straw, forestry and horticultural waste. The algorithm draws from a combination of remote sensing data, geographic information, meteorological data and time series data to effectively detect and identify instances of stubble burning in agricultural fields. NPA provided the

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unique ID's of the 2022 burned fields in August to enhance the validity of the results. The "**Minimum Soil Cover**" service's purpose is to determine whether there is sufficient vegetation or soil cover on agricultural fields to prevent soil erosion and maintain soil health. End-users can efficiently identify and take necessary actions against applicants who do not comply with the Cross-Compliance GAEC06, which requires sowing or planting agricultural crops on black fallow until October 1 of each year, ensuring regulatory enforcement and early sanctions prevention. The service's value is exemplified by its contribution to sustainable land management practices and the protection of soil resources. NPA provided the 2020 inspection data shapefile with this CC GAEC requirement non-compliances to improve the productivity of this algorithm. This service, specifically regarding black fallow sowing, uses remote sensing data, geographic information and time series data to produce a clear output that assesses compliance with soil cover regulations. The "**Runoff Risk Assessment for the Reduction of Water Pollution in Nitrate Vulnerable Areas**" service plays a pivotal role in supporting the assessment and reduction of nitrate pollution risks in environmentally sensitive areas. It serves as a valuable tool for regulatory enforcement, informed decision-making, environmental conservation, and water quality protection. This algorithm is designed to identify areas or fields in Lithuania that are at a higher risk of contributing to water pollution, particularly nitrate pollution. The service provides assessments of nitrate runoff risk, highlighting areas at high risk of contamination, and assists in the development and enforcement of regulatory measures to protect water quality. NPA provided the Lithuanian water coastal protection belts layer and the Lithuanian water bodies layer for the development of this service. So basically, the algorithm relies on nitrate concentration and pollution reduction measures data to assess the risk of nitrate pollution in environmentally specific areas.

The "**Grasslands Mowing Events Detection**" data product is a valuable tool for monitoring and assessing mowing activities in pastures, meadows and other grassland areas. The product aids in identifying whether grasslands are mowed before specific dates or within regulatory timeframes, contributing to the enforcement of environmental policies and the preservation of natural habitats. NPA provided GSAA 2022/2023 datasets for the installation of this data product. This algorithm uses vegetation density and biomass data, geospatial data and time series data to accurately identify and track mowing events in grasslands. These inputs provide the algorithm with the information needed to determine when mowing activities took place, where they occurred, and how frequently they happen. End-users can make informed decisions based on the detected events, ensuring that grasslands are managed in compliance with regulations.

The data product "**Cultivated Crop Type Maps**" is designed to understand the distribution of crop types on arable land. It provides data-driven insights into the types of crops cultivated in specific fields, aiding inspectors in confirming compliance with the declared crop type. The algorithm utilises spectral signatures, temporal data and crop growth models to accurately identify and map the types of crops being cultivated on arable land. NPA shared the timetable of in-situ data collection and scheduled on-the-spot checks with technical partners to have a full picture of these results validation. As a result, an algorithm was developed that plays a significant role in checking the accuracy of crop declarations and assessing compliance with regulatory requirements, including the stipulation that declared crops are physically present in the field by a certain date.

ID	Data Product	Services	Input/Output	Integration	Risks
DP1	**Analytics on Vegetation and Soil Index Time-series**	Harvest Events Detection	Input: GSAA 2022/2023 data Output: A map showing parcels with detected harvest events	AMS	The service may incorrectly identify non-harvest events as harvest events, leading to inaccurate information on the map.

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		Stubble Burning Identification on Arable Land	Input: GSAA 2022/2023 data; Data from the Fire Department Output: Burnt parcels	AMS	The service may incorrectly identify non-stubble burning areas as burnt parcels, leading to inaccurate information. If farmers continue this practice despite the identification, it poses a risk to the environment and public health.
		Minimum Soil Cover for Soil Erosion	Input: GSAA 2022/2023 data; 2020 inspection data Output: Black fallow parcels in accordance with GAEC04 regulations	AMS	The service might miss actual instances of non-compliance, allowing harmful farming practices to continue, contributing to soil erosion.
		Runoff Risk Assessment for the Reduction of Water Pollution in Nitrate Vulnerable Areas	Input: Lithuanian water protection zones; Lithuanian water bodies Output: Runoff risk level for each parcel	AMS	The algorithm's accuracy heavily relies on the quality of input data. Mistakes or inaccuracies in the delineation of water protection zones and water bodies can lead to incorrect risk assessments.
DP2	**Cultivated Crop Type Maps**	Confirmation of GSSA	Input: GSAA 2022/2023 data; Timetable of in-situ data collection and scheduled on-the-spot checks Output: Crop classification scheme	AMS	The service may misclassify crops, resulting in false positives (identifying a crop that isn't there) and false negatives (missing actual crops). Inaccurate crop classifications can have financial implications for farmers. If their crops are misclassified, they may not receive appropriate compensation, subsidies or other support.
		Smart Sampling for OTSC Inspections	#N/A	#N/A	#N/A
		Crops Diversification Compliance	Input: GSAA 2022/2023 data; Timetable of in-situ data collection and scheduled on-the-spot checks Output: Crop classification scheme	AMS	If the service inaccurately classifies crops, it can result in farmers not meeting diversification compliance requirements.

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DP3	**Grassland Mowing Events Detection**	Grassland Activity Monitoring and Management	Input: GSAA 2022/2023 data Output: Mowing alert timestamps	AMS	The service may generate false mowing alerts, indicating mowing events that did not occur. Inaccurate alerts can lead to inefficient resource allocation. Sending inspectors to areas with false alerts can waste resources.

Table 21. Input/output, integration and potential risks of the Lithuanian BC data products and service

Milestones

The milestones that have been achieved for the Lithuanian BC are shown in the table below.

Milestones No	Milestone Name	Achievement (yes/no)	Achievement Date	Mean of verifications
BC M1	Deployment of the first version of the services.	Yes	End of Feb	The initial version of data products is delivered. (D3.4)
BC M2	BC level meetings, workshops and technical support.	Yes	End of May	Regular meetings, workshops and technical support organised.
BC M3	Define Evaluation criteria	Yes	End of Jun	The Evaluation criteria Developed (D5.3)
BC M4	BC level meetings, workshops and technical support.	Yes	End of Sep	Regular meetings, workshops and technical support organised
BC M5	Intermediate business case implementation report	Yes	End of-Oct	Intermediate business Case implementation report (D5.4)
BC M6	Intermediate evaluation report.	Yes	End of Oct	Intermediate report on the evaluation of services (D5.5)
BC M7	Delivering improved Envision Data product and Services though the platform.	Yes	End of Dec	The improved Envision of Data product and Services delivered.
BC M8	BC level meetings, workshops and technical support.	Yes	End of May 2023	Regular meetings, workshops and technical support organised
BC M9	Final business case implementation report	Yes	End of Jun 2023	Final business case implementation report (D5.6)
BC M10	Final evaluation report	Yes	End of Jun 2023	Final report on the evaluation of services (D5.7)

Table 22. *Lithuanian BC Milestones*

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3.3 Flemish Business case

Generic Information of Business Case

Flemish Business Case					
Business Customer:	LV Flanders (BE)	***Type of organisation:***	Paying Agency (PA)		
Business case Facilitator	Sebastiaan Philips				
BC Description:	This business case focuses on the Soil Organic Carbon Monitoring at the parcel level.				
Implementation area	Flemish region (large scale).				
Data Products	***Service***				
DP4: Soil condition monitoring	Top-soil qualitative soil organic carbon estimations				
BC Partners	***LV***	***EV-ILVO***	***DRXS***	***AgroApps***	***FARMERS***
Partners Role	BCF	WPL	PP	SP	EnU
	PSC	SP	BCE	BCE	BCE
	DP	DP			
	EnU	BCE			
	BCE				

Table 23. Generic information of the Flemish BC

Current CAP's 6th GAEC requires the maintenance of soil organic matter level through appropriate agricultural practices. The objectives of the future CAP's GAECs include: maintenance of soil organic matter (GAEC 3), minimum land management reflecting site-specific conditions to limit erosion (GAEC 5), protection of soil in winter (GAEC 6) and preservation of soil potential through crop rotation(GAEC 7). Moreover, MS can define in their Strategic Plans voluntary Eco-schemes on soils with different levels of ambition. In this context, the continuous spatial and temporal monitoring of the SOC content in agricultural soils becomes extremely important, not only from the environmental perspective -to limit soil degradation- but also in economic terms to ensure that the beneficiaries of the CAP follow the obligations under the conditionalities and voluntary schemes.

Currently, the state of agricultural soils is checked by performing soil samplings and conducting laboratory examinations. However, these methods do not provide a continuous overview of the state of soils and they require significant effort, time, and resources to be committed. These types of controls could be significantly reduced and replaced with a more automated process.

Flemish business case focuses on Soil Organic Carbon Monitoring at the parcel level, using EO-data and ML techniques. its goal is to simplify and enhance the SOC monitoring process to meet the related CAP requirements for cropland.

The specific objective is to create a service that predicts soil OC content for Flemish plots, informing and raising awareness among farmers about their soil conditions.

The Service will adjust to provide estimations for the whole Flemish region (large scale).**Data Product**

Description:

For the needs of Soil Conditions monitoring, two products were developed that allow the relative monitoring with a high level of accuracy, using a methodology which is testing within the Flemish Business Case.

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- **The first product is a soil quality map at a pixel level**, using an indicator that informs if the pixels have Topsoil Organic Carbon value below the average, around the average, above the average and far above the average, considering soil-pedoclimatic conditions. Indicator values have been assigned to 10m by 10m pixels, using as a mask arable crops parcels
- **The second product is a soil quality map at a parcel level,** using an indicator that informs if a parcel has a median Topsoil Organic Carbon (TopSOC) value below the average, around the average, above the average and far above the average, considering soil-pedoclimatic conditions. Indicators are assigned to the arable crop parcels by performing a spatial aggregation, using the 10m by 10m pixels as a source.

Identified product usage scenario (service business logic) and testing process

The accuracy of the model controls the SOC service logic. Defining and adjusting the SOC service's business logic to the LV needs and the achieved accuracy levels is critical. The accuracy needs to support the SOC monitoring at the parcel level and not only the identification of low organic carbon zones like in Smart farming applications.

➢ After the first product results from the beginning of BC implementation (March 2022), EV ILVO and LV have come to first solid conclusions on how to present the information in different accuracy scenarios.

Possible use of the service:

Objective: Visualization of the results in LV CAP applications like the soil passport

1. No policy follow-up but rather policy steering and pushing towards AECM (Agri-environment-climate Measures) and eco-schemes in the new CAP.

- FAST advice: insight for the farmer into the 'class' of carbon of the plot.

2. Risk analyses and risk management: A lot depends on ultimate accuracy.

- But if the error is e.g. 0.5%, show classes + - 0.5%
- Compare plot with benchmark parcels around - relative values

➢ Within the second iteration considering the modelling results of Scenario C, has been improved. If accuracy can still be improved, it shows potential for the use of the SOC maps as a benchmark and reference to farmers in maintaining SOC contents at an appropriate level and optimising decisions for sustainable land use.

✓ Following the delivery of the product results of the 2nd iteration, a workshop was organised with LV and ILVO (October 2022) to further discuss and define the product usage scenario (service business logic) of the SOC product for the continuous assessment and testing of the services. As a result, It was decided that; The service should be able to provide for each parcel in Flanders a class of SOC, not a quantitative number.

➢ This effort has been continued, considering new accuracy results (higher) and info coming for the XAI graphs. The goal is to develop definitive answers to questions such as the following by the end of December:

- Which is the optimal/suggested frequency for updates?
- How are we going to present the SOC values?
- How are we going to estimate, deliver and show the accuracy of the assessment?
- How can we accurately and without risk identify SOC degradation parcels?
- May we use the SOC monitoring to motivate or award Farmers?

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- In the third iteration phase, a decision was made to assess soil quality indicators considering the expressed needs for monitoring with the new CAP. These data products are created at both pixel and parcel levels, considering pedoclimatic conditions.

Validation Process:

Technical validation and service evaluation are carried out, which involves the validation of a complete solution or a segment of a solution that was about to be or had already been implemented to ascertain how well the solution met the business needs and delivered value to the organization. Within the ENVISION project, the technical validation is performed within WP3 (for more detail please see D3.6), primarily in Task 3.8, and the service evaluation is conducted within WP5 and Task 5.3. Valuable inputs were the end-user requirements from WP2 and the end-user evaluation feedback from WP5. Technical validation is an important activity that focuses on the accuracy of the models and investigates scenarios from improvements built and test them.

Progress on Implementation Phase

- Since 01/03/2022, four Progress Reports were submitted: (April 30th 2022, September 30th, 2022, January 31st 2023, May 31st, 2023)
- During the different steps of the implementation process, all BC partners worked in close collaboration.
  - Until now, 17 BC meetings have been held with all BC actors and the minutes of the meetings have been prepared and distributed. In BC meetings, the current state of progress in BC, next steps, existing and/or potential roadblocks and solutions were discussed.
  - Besides the monthly BC meetings, additional meetings have been held whenever it is necessary for one of the partners.
  - Regular updates took place at WP leader's monthly meetings
- In addition, technical sessions took place as part of the progress meeting and extra technical meetings were organised where necessary. These interactions involved,
  - The explanation of algorithms,
  - Technical validation and feedback sharing on data product results and visualization
- After each iteration, the results of SOC data product were presented to LV and demonstrations were organized for the visualisation of the SOC product on the platform
  - After a first evaluation of the initial results of the SOC product (Feb 22), which showed that the accuracy of the SOC product needs to be improved, EV ILVO continued to work on models and carried out further tests to improve the accuracy (work performed within WP3).
  - An improvement was made in the second iteration based on the model results of scenario C. If the accuracy can be further improved, it shows potential for the use of the SOC maps as a benchmark and reference to farmers in maintaining SOC contents at an appropriate level and optimising decisions for sustainable land use.
    - ✓ At the beginning, in line with the validation and evaluation of the product results with LV, the top Soil SOC predictions were classified into classes (utilizing float values between 0 and 4, representing the % of top SOC) with reference to the suggested classes and without considering the texture information. Categories such as Low, Medium, and High were used for this classification. The adoption of classes better

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supported the definition of rules and logic, similar to the logic of the Traffic lights in CAP monitoring.

- Within the third iteration phase, EV ILVO continued the work on the modelling to improve the accuracy. EV ILVO developed and tested several regression models.
  - ✓ After the evaluation of the results by LV, the Value base and the distribution approach as explained in the D3.7 sections "Soil Health and Soil Quality" and "Flemish Soil Quality Indicators, soil-pedoclimatic conditions and approaches tested.", for the development of the data products.
- EV ILVO Improved the accuracy of the topsoil organic carbon prediction models and finalised the modelling process.

- The Flemish Soil Quality Maps that use as an indicator the predictions of the topsoil organic carbon model, also considering the pedological conditions were developed and presented.
  - **A soil quality map at a pixel level**, using an indicator that informs if the pixels have Topsoil Organic Carbon value below the average, around the average, above the average and far above the average
  - **A soil quality map at a parcel level**, using an indicator that informs if a parcel has a median Topsoil Organic Carbon value below the average, around the average, above the average and far above the average.
- In a collaboration between EV ILVO and LV, a developed product was presented at the Flemish AgriTEF day in June 2023. and feedback was collected from farmers on its usefulness.
- During the implementation phase, LV provided necessary information such as:
  - presentation of soil criteria in the future CAP to support the development of SOC business logic,
  - carbon content target zones to support the development of SOC services.
  - data sets to develop the data products, consisting of the Flemish Agricultural Parcels. This file aggregates the Top Soil Organic Carbon Assessments at the parcel level.

Short description of Data/information	Focused Crop type	Focused area (location-size)	Data- format	Related data product/s	Related activity	Purpose of the data/information provided
Presentation on soil criteria in future CAP			Powerpoint		A3	Development of SOC service business logic
Carbon content target zones			Table		A11	To be able to divide results in classes
Data sets (Flemish Agricultural Parcels)						This file aggregates the Top Soil Organic Carbon Assessments at the parcel level.

Table 24. Flemish BC Provided Data/information by Business case customer to the Services Provider M19-M36

Progress on Evaluation Phase

- Validation was done on the model, based on the currently obtained results and LV gave feedback to EV ILVO on the latest results of the data product and on the visualization of the product results on the platform.
- After each iteration, the results of the SOC data product were presented to LV and demonstrations were organized for the visualisation of the SOC product on the platform. Critical decisions were

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also made on how to present the information to the service consumers or the end-users. EV ILVO and LV continued with this effort considering new accuracy results and the specific CAP needs for monitoring coming from LV.

- After a first evaluation of the initial results of the SOC product (Feb 22),which showed that the accuracy of the SOC product needs to be improved, EV ILVO and LV have come to first solid conclusions on how to present the information in different accuracy scenarios (see the Identified product usage scenario above).
- After delivering the product results of the 2nd iteration, a workshop was held in October with LV and ILVO to explore and define alternative usage scenarios for the SOC product. The focus was on defining the service business logic and how to present information in different accuracy scenarios
  - ✓ Information was provided on the content of the Strategic Plan related to soil monitoring requirements (in terms of soil organic carbon) with a listed potential usage scenario of the SOC monitoring product to support the strategy plan (considering current and improved accuracy) by LV.
  - ✓ As a result, it was decided that the service should be able to provide for each parcel in Flanders a class of SOC, not a quantitative number.
- In the third iteration phase, a decision was made to pass from topSOC prediction to the development of soil quality data products. At the Envision project, the goal is provide Soil Quality Indicator for Top Soil Organic Carbon, considering also the model accuracy and the specific CAP needs for monitoring coming from LV. This data product will be created at both pixel and parcel level, considering pedoclimatic conditions (see D3.7 pages 70-76).

- In a collaboration between EV ILVO and LV, the Soil Quality data product was presented at the Flemish AgriTEF day in June 2023. and feedback was collected from farmers on its usefulness.
  - Farmers have provided valuable feedback on the Soil Organic Carbon (SOC) monitoring data product. They find it useful for identifying areas needing attention and for comparing their parcels with similar ones. These feedbacks highlights the product's practicality in assisting farmers with making informed decisions about their land. However, there were also some concerns, mainly related to security, privacy and trust. Some farmers expressed concerns about who would have access to see and use the SOC values and for what purposes and they emphasized the need for greater control over who can access to this information.
- LV actively co-developed the evaluation criteria and their indicators by participating in the workshop organized in Thessaloniki and providing feedback during the consultation process.
- Before each evaluation phase the criteria and indicators have been reviewed, refined and enriched by ILVO through consultation with all BC actors (see D5.5 Section 3.2, D5.7 Section 3.1)
- Defined criteria and indicators linked with relevant data products and services of the BC (see D5.7 Section. 3.1)
- LV participated in workshops and performed questionnaire surveys to evaluate the Envision data product and services and its added business value.
  - For the intermediate evaluation, 2 workshops, and 2 questionnaire surveys.
  - For The final evaluation, 1 workshop, and 2 questionnaire surveys.
  - For both the intermediate and Final evaluation, LV provided Impact Indicator Values (Baseline-Target-Estimated Values) for impact assessment of the Data Product/services.

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Collected Feedbacks

During the implementation of the BC, collected feedback for the Flemish BC to monitor the progress of the BC and evaluate the Envision data product and services presented in the table below.

No.	Feedback Report Title	Related Activity No.	Nature	Due Date (DD/MM/YYYY)	Comments
1	Progress report	**A31** Reporting on the Business Cases progress	R	30/04/2022	
2	Progress report	**A31** Reporting on the Business Cases progress	R	30/09/2022	
3	Progress report	**A31** Reporting on the Business Cases progress	R	31/01/2023	
4	Progress report	**A31** Reporting on the Business Cases progress	R	31/05/2023	
5	Impact Indicator Values (Baseline-Target-Estimated Values)	**A38:** Provide the Baseline information, if needed	R, S	26/10/2022 10/10/2023	
4	Survey "Evaluation of the business value and acceptance"	**A35**: Provide input to the workshops, events and questionnaire surveys, A26: Providing feedback as we deal with B2C and B2B scenarios.	S	18/10/2022 10/10/2022	
6	Survey "Evaluation of Performance, Usability And Effectiveness"	**A35:** Provide input to the workshops, events and questionnaire surveys	S	18/10/2022 10/10/2022	
7	17 BC progress meeting	**A27:** Periodically holding meetings and calls at the BC level and prepare and distribute BC level meeting agenda and minutes, **A35:** Provide input to the workshops, events and questionnaire surveys, A26: Providing feedback as we deal with B2C and B2B scenarios	MW	March 2022-October 2023	
8	5 BC Evaluation Workshop	**A37:** Define Evaluation criteria, **A35:** Provide input to the workshops, events and questionnaire surveys, **A26:** Providing feedback as we deal with B2C and B2B scenarios	MW	March 2022-October 2023	

Table 25. Flemish BC Collected Feedback M19-M36

For the description of the nature, the following options should be used: R - document, report;

DEM - demonstration; MW- meetings, webinars and workshops, S- surveys

Challenges/Risk and mitigation

The main risks identified and difficulties faced by Flemish BC are summarised in the table below, along with a brief explanation of how they were managed:

Declared relevant activity	Challenges/Risk	Solutions/Mitigation
A3: Developing the business flow (or business logic) within the BC A11: Validate the products and services	The model's accuracy does not adequately support the required SOC service logic	Tests were done to ameliorate the model, and Key decisions were taken regarding the presentation of information to service consumers or end-users, considering varying accuracy levels. Diverse usage scenarios have been developed to accommodate different

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		accuracy levels, each tailored to specific needs. This ensures the usefulness and usability of the services. And As explained in D3.7, the final data products provide Soil Quality indicators. By using the distribution method, it's possible to identify a zone in the Flemish region where the expected TopSOC is below, close, or above the average, also considering the pedoclimate conditions. This approach allows the identification of zones within the parcel where the conditions are not favourable. The distribution method allows monitoring because it allows assessing if a parcel's soil conditions are below the expected, considering the overall needs in an area under study (for example, a region) together with the pedoclimate conditions
A38: Provide the Baseline information, if needed	For some Indicators, LV has difficulties in providing baseline data. The service is a new product and aims to provide with a new way of assessing soil criteria like OC. It is as a consequence difficult to find baseline information on much of the criteria.	To facilitate the process, WPL developed a template that offers several options for the data sources and evaluation methods. So baseline information that cannot be collected will be supplemented by expert judgement.

Table 26. Flemish BC Challenges/Risk and Mitigation

Analyzed Challenges and lessons learned

- Soil sampling campaigns, aiming to support the development of TopSOC prediction models with the provision of training and validation data sets, should be carefully designed, considering various parameters that control the quality of the resulting digital signature libraries. Before the fieldwork, a bare soil collection needs to exist to be used together with other parameters like the soil type or the land use to identify soil sampling locations that vary in terms of spectral reflection signatures. This variation needs to be able to support the mapping of different TopSOC values at the full possible TopSOC value range and per different soil texture conditions
- The use of the extra soil labs measurement, coming from various Flemish initiatives like the Carbon Monitoring network, can increase the accuracy of the model, allowing not only the relative monitoring of the TopSOC conditions but also the provision of accurate absolute values which are needed for the calculation of the changes through time at parcel level.
- To overcome GDPR issues, data products can be provided by using an API. This way, a farmer can request to see the intra-field soil quality conditions only for his parcels. The demonstration took place on the Flemish AgriTEF Day, collaborating with the Flemish Department of Agriculture (LV), allowing EV ILVO to consume an API that delivers per Farm the agricultural parcels. We used DjustConnect authorisation and data consent services.

Results

For the needs of Soil Conditions monitoring, two products were developed for the Flemish Business Case:

• A soil quality map at a pixel level, using an indicator that informs if the pixels have Topsoil Organic Carbon value below the average, around the average, above the average and far above the average, considering soil-pedoclimatic conditions. Indicator values have been assigned to 10m by 10m pixels, using as a mask arable crops parcels

• A soil quality map at a parcel level, using an indicator that informs if a parcel has a median Topsoil Organic Carbon value below the average, around the average, above the average and

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far above the average, considering soil-pedoclimatic conditions. Indicator values have been assigned to the arable crops parcels by performing a spatial aggregation, using the 10m by10m pixels as a source.

The provided innovative service allows the continues monitoring of soil quality with low cost at large scale using topsoil organic carbon (TopSOC) indicators extracted from machine learning models considering the pedoclimate conditions. The models can predict for each area unit of 10m by 10m, the percentage of TopSOC and after we can aggregate this information at parcel level or for a specific area of interest (AOI). The service allows the relative monitoring with a high level of accuracy.

The users can have access to the products:

- By using the Envision platform and its services. There it is possible to see on a map both data products, together with the LPIS parcels and evaluate the conditions either at parcel level or at regional level. Envision platform visualize the data products using WMS services.

- By using an API and making a request for a specific AOI. This allows the development of web applications where the users, in our case Farmers, can make on-demand requests for a data product for a specific AOI (polygon). This ability was demonstrated at the AgriTEF Dag in Flanders on Jun 6, 2022, and evaluated positively by the Flemish farmers and also the Flemish Department of Agriculture.

The SOC monitoring product is useful for monitoring CAP's soil requirements (in terms of soil organic carbon) and supporting the maintenance of soil organic matter levels relative to the current and future CAP requirements. End-users may use service results to get insights and information on tillage, drainage, and overall agricultural management practices.

The developed product will be used as a baseline within then Flemish Soil Passport in a way to allow the relative SOC monitoring as presented at the AgriTEF day.

Policy makers: The service creates insight in the condition of the soil for the whole of Flanders, making it possible for the policy makers to react for example when a trend is noticed of decrease in soil condition over the years.

Farmers: Farmers can get insight and be aware of their soil conditions to promote better farm management.

Certification Bodies: The enrichment of the training set with more records (lab measurements of soil samples collected within a pixel area) will increase the accuracy of the model, allowing not only the relative monitoring of the TopSOC conditions but also the provision of accurate absolute values which are needed for the calculation of the changes through time at the parcel level. That means that the Certification Bodies can also use Envision Soil Quality data products by applying fixed threshold values which depend on the pedoclimatic conditions (D3.7).

This product addresses the following environmental impacts:

Soil degradation – the quantity of SOC within agricultural soils provides information on tillage, drainage, and overall agricultural management practices.

Relation with new CAP

Climate change mitigation and adaptation, including by reducing greenhouse gas emissions and enhancing carbon sequestration or environmental care by fostering sustainable development and efficient management of natural resources such as water, soil and air, including by reducing chemical dependency and by focusing on soil as one of the most important natural resources, supplying essential nutrients, water, oxygen and support for plants. All these issues are closely related to soil health and so interventions and policy which promote soil protection are important in the new CAP.

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Apart from interventions that promote sampling the soil and its nutrients and health, it is also very important if not more important to create insight for the farmers on the health of their soil to reach these objectives. For the Flanders administration, it is important to be able to follow up on trends in soil organic carbon over the years for the whole territory of Flanders.

Through the service of ILVO,

LV can monitor the soil conditions on a yearly bases and so adapt policy according to the results of the service;

Farmers can get insight and be aware of their soil conditions for better to promote better farm management.

Milestones

The milestones that have been achieved for the Flemish BC are shown in the table below.

Milestones No	Milestone Name	Achievement (yes/no)	Achievement Date	Mean of verifications
BC M1	Deployment of the first version of the services.	Yes	End of Feb	The initial version of data products is delivered. (D3.4)
BC M2	BC level meetings, workshops and technical support.	Yes	End of May	Regular meetings, workshops and technical support organised.
BC M3	Define Evaluation criteria	Yes	End of Jun	The Evaluation criteria Developed (D5.3)
BC M4	BC level meetings, workshops and technical support.	Yes	End of Sep	Regular meetings, workshops and technical support organised
BC M5	Intermediate business case implementation report	Yes	End of-Oct	Intermediate business Case implementation report (D5.4)
BC M6	Intermediate evaluation report.	Yes	End of Oct	Intermediate report on the evaluation of services (D5.5)
BC M7	Delivering improved Envision Data product and Services though the platform.	Yes	End of Dec	The improved Envision of Data product and Services delivered.
BC M8	BC level meetings, workshops and technical support.	Yes	End of May 2023	Regular meetings, workshops and technical support organised
BC M9	Final business case implementation report	Yes	End of Jun 2023	Final business case implementation report (D5.6)
BC M10	Final evaluation report	Yes	End of Jun 2023	Final report on the evaluation of services (D5.7)

Table 27. Flemish BC Milestones

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3.4 Serbian Business Case

Generic Information of Business case

Serbian Business Case						
Business Customer:	OCS	***Type of organisation:***	Certification Body (CB)			
Business case Facilitator	Svetlana Vitomirović, Kosta Novaković,, Bojana Lendvaji Vignjević					
BC Description:	This Business case focuses on employing ENVISION's services to demonstrate how the uptake of EO technology can improve the overall monitoring of organic certification requirements.					
Implementation area	OCS decided to localise testing on Vojvodina (Northern part of Serbia) and on 4 plant species: wheat, corn (maize), sunflower and soybean.					
Data Products	***Service***					
DP5: Crop growth Monitoring and identification of organic farming practices	Distinction of organic farming practices					
	Crop growth monitoring					
BC Partners	***EV-ILVO***	***OCS***	***DRXS***	***AgroApps***	***INOSENSE***	***FARMERS***
Partners Role	WPL	BCF	PP	SP	DP	EnU
		PSC	BCE	BCE	BCE	BCE
		DP				
		EnU				
		BCE				

Table 28.Generic information of the Serbian BC

Organic farmers in Serbia are required to comply with the **Law on Organic Production**[1]; this Law is designed to be fully in line with environmental EU legislation in respect to the conservation of the environment as a vital objective of organic agriculture.

To that end, there are several requirements that farmers need to follow (limits to fertilisation, mandatory buffer strips, soil erosion prevention, nutrient management etc.) to acquire and maintain an organic certification. Organic certification bodies are responsible for evaluating their performance and compliance to environmental rules by performing on-farm checks.

OCS's organic certification process consists of two parts: 1) **preparation period**, which includes office work where the checklist for the on-site controls is prepared, and 2) **on-site control**, which includes: (i) checking of farmer records, working dairy, and other relevant documentation, and (ii) on-site monitoring of farm biodiversity, soil fertility and soil structure, the usage of prohibited substances, and measurements of buffer zones, strings, rows.

The process of organic certification needs to be both digitised and enhanced in relation to monitoring environmentally friendly practices remotely; the administrative burdens and costs of current methods significantly hinder the monitoring procedure of organic farming requirements. EO-based technologies and information will be employed to enhance OCS's inspection process by enabling the easy and continuous monitoring of several organic requirements, all year round. The ENVISION service will be used to provide warnings and information to farmers related to their declarations. Farmers will be involved through the existing networks of Serbian partners.

This Business case focuses on employing ENVISION's services to demonstrate how the uptake of remote and continuous monitoring through the EO technology can improve the overall monitoring of

[1] Chamber of Commerce and Industry of Serbia, 2016. Available at http://www.pks.rs/SADRZAJ/Files/OPC%20Brosura%20ENG.pdf

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organic certification requirements. Farmers will be involved through the existing networks of Serbian partners.

Data Product Description: OCS, for the needs of distinction of organic – conventional farming, developed two products, using a methodology which is testing within the Serbian Business Case: Distinction of organic farming practices and Crop growth monitoring / Crop phenology monitoring. This product offers an Organic Crop Identification Service, focusing on verifying the organic classification of declared crop types using a user-friendly traffic light system. Distinguishing between organic and conventional crops relies on identifying unique bio-chemico-physical disparities, often observable via satellite imagery, particularly during the vegetative and reproductive growth stages. Leveraging these disparities, Identification of Organic Farming Practices service discerns between organic and non-organic (conventional) crops. This service operates by recognizing distinctive patterns characteristic of the growth and development of both organic and conventional crops throughout the growing season, by training advanced Machine Learning Classifiers (MLC). This is achieved through the application of high-resolution optical satellite images and the extraction of image features depicting the phenological status of cultivated parcels.

Addressed problems and objections: Identification organic from conventional practise

Identified a product usage scenario (service business logic) and testing process

From the beginning of BC implementation (March 2022), OCS has identified a product usage scenario (service business logic) for the continuous assessment and testing of services. In this scenario,

- OCS will assess the extent to which the developed services and products can facilitate and improve monitoring and inspection activities of the organic certification process in terms of reduction of time, cost and effort and improved decision-making.
- OCS will test the ability of the services to determine the difference between organic and conventional farming by comparing data on the rate of accumulation of crop biomass and other biophysical parameters between plots growing the same crop and declared as organic or conventional.
- It has been decided to localise testing on Vojvodina (Northern part of Serbia – this is an area with similar climatic and soil conditions) and on four plant species: wheat, corn (maize), sunflower and soybean.
    - OCS imported farmers' declarations on the ENVISION platform which confirmed if these crops are organic and after that OCS checked it on the spot. In the inspection OCS identified parcels (from Timestamp with coordinates and from GeoSerbia application which confirmed that inspector was exact on this parcel which was the scope of inspection). For example OCS inspector confirmed that on the parcel 5158 in the cadastral municipality Kanjiža is organic wheat and ENVISION service confirmed the same thing before. Another inspector confirmed that on the parcel 12588/2 in Cadastral municipality Čurug is organic soybean and ENVISION service confirmed the same thing before. Inspector also took a sample to confirm if it is soybean with non-GMO and analysis confirmed it. Further, the inspector confirmed that parcel 5655 in Cadastral municipality Gospođinci is organic maize and ENVISION service confirmed the same thing before. Inspector also took a sample to confirm if it is maize without pesticide residues and analysis confirmed it. On the other hand, the inspector confirmed that on parcel 786 in cadastral municipality Dobričevo sowing was very late and sunflowers have different vegetation periods in comparison with other sunflowers. Almost the whole year this soil was without crop. This was confirmed and notified from the platform as irregularity and checked on the spot. Also, OCS found some other irregularity when AgroApps informed about some very strange NDVI results from wheat. OCS checked if it coordinates well, and it was confirmed that it has the same parcel on Geo Serbia and ENVISION platform. And then OCS found that there were trees on the boundaries of those strange parcels. This information was very

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important for OCS, because farmers declared all parcels that are with the same crop, but it is not real. From the other side it is impossible for an inspector to see imaginary boundaries without any digital tools.

Validation process

- The product results were compared with results from on-site inspections. If the farmer has a smaller number of parcels (less than 20), OCS checked on site 100% of parcels. If a farmer has a larger number of parcels, OCS checked a minimum 50% up to about 80% of parcels (depending on the number of parcels, their area and the heterogeneity of their location).
- OCS collected data for organic and conventional parcels (crop types and variety on certain parcels, soil organic carbon, yield and of course farming practices - organic or conventional).
- OCS prepared for inspections of all imported parcels and in 2023. all imported parcels checked on the spot.
- In future, focus will be only on parcels that the platform declares as non-compliant.

Progress on Implementation Phase

- Since 01/03/2022, four Progress Reports were submitted: (April 30th 2022, September 30th, 2022, January 31st 2023, May 31st, 2023)
- To task of distinguishing organic from conventional farming practices with the use of EO data was indeed very challenging. Initially, regarding the strategy, decisions had to be made about what EO derived classification features to use for the discrimination. Data dimensionality and more practical reasons regarding the spatial data extent and the available data space posed a certain limit as to how many features to use. The discussion was about whether to focus more on the spectral or the spatiotemporal content of the EO data. Clear scientific evidence about "a defined spectral signature" of an organic farming practice wasn't found in the literature, rather than some few experimental cases that focused solely on crop/leaf canopy nutrient content. These studies used very high resolution multispectral and hyperspectral data, questioned the problem on specific crop varieties and on a highly local scale experimental plots, relying on abundant ground truth data about nutrient NPK inputs. On Envision,it was known from the start, that such in situ data were not available at a national scale. It was finally resolved , to focus more on the spatiotemporal aspects of vegetation phenology in the EO signal.
- During the different steps of the implementation process, all BC partners worked in close collaboration.
    - Until now, 20 BC meetings have been held with all BC actors and the minutes of the meeting have been prepared and distributed. In BC meetings, the current state of progress in BC, next steps, existing and/or potential roadblocks and solutions were discussed.
    - Beside the monthly BC meetings, additional meetings have been held whenever it is necessary for one of the partners.
    - Regular updates took place at WP leader's monthly meetings
- Technical support and instructions for data collection, use and testing of services/platform were also provided together with the documentation produced by AgroApps and DRAXIS providers.
    - Technical sessions took place as part of the progress meetings and extra technical meetings were organised where necessary.4 extra meetings took place in addition to the BC progress meetings between OCS, Agroaaps, Draxis and Inosens.
    - A list of data specifications was shared with the end-users and the data collection was initiated.

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- Throughout the development phase, meetings were held to clarify possible mismatches derived from the service. Presentations/ diagrams and workflows were prepared in order to facilitate the communication process.
- Regarding the platform development, the technical team dedicated several meetings in order to customize some of the platform's features to the case's specificalities. For instance, the import functionality differs from the other cases since an integration with the Geoserbija was performed.
- OCS received clear guidelines from AgroApps on how the platform and mobile app should be used and tested.
- Technical support regarding the uploading of the parcels provided.
  - The problems with inserting data into the template and the platform were solved by setting computers to srecognise those files exclusively in the Libreoffice.
  - Agroapps and Inosens together solved the problem related to Latin letters in the csv file (č, ć and đ) so that OCS could enter data on the platform without any problems.
  - GeoSerbia hacked and after that, they denied access to foreign countries, which made it impossible to import any more data on the platform. Therefore, InoSens provided a solution that could facilitate the smooth continuation of the pilot implementation. The technical teams of both companies (DRAXIS and InoSens) worked together, and the connection was restored.

- Moreover, data and results are continuously exchanged to discuss ways to meet BC's needs and improve services.
- The initial approaches/methods and results of the analysed data were presented and discussed with OCS to obtain feedback and improve the quality of data collection, thus improving service delivery.
  - OCS collected and provided necessary information and data to support and feed the ENVISION data product and services such as; Parcels identification, recognition & monitoring, declared parcels from farmers, information on which parcels have been inspected (see table 22).
    - OCS has uploaded the declared parcels from farmers to the platform (start from June, every second week in month, in 2022 and on the same way in 2023).
    - OCS imports organic and conventional parcels on the ENVISION platform in real time in 2023.
    - After 5.191 parcels were collected from the period 2016. by 2020, only 4.201 parcels were useful for machine learning (2.335 conventional parcels and 1.866 organic parcels). 306 organic parcels in 2022 were imported into the platform (crop 2022) and 229 parcels for crop 2023 (98% parcels checked on the spot and confirmed that are crops that are declared by farmers or it is a different crop and is it organic farming practices are using).

Short description of Data/information	Focused Crop type	Focused area	Data-format	Related data product/s	Related activity	Purpose of the data/information provided

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		(location-size)				
Data collections of parcels with cadastral, parcel ID, type of crop and physically checked or not all data in document "Parcels identification, recognition & monitoring"	Wheat, sunflower, maize and soybean	Vojvodina	.csv	2022 and 2023 Envision portal	A11 (Checked on spot in 2022 and 2023)	Validation the product and layer top of the map (green and red)
GeoSrbija	Wheat, sunflower, maize and soybean	Vojvodina	.csv	2022 and 2023 Envision portal	A11 (Checked on spot in 2022 and 2023)	Validation the product and layer top of the map (green and red)

Table 29. Serbian BC Provided Data/information by Business case customer to the Services Provider M19-M36

- During the previous reporting periods, the distinction service was not operational since many adaptations needed to be performed based on the OCS' feedback and the initial results provided. OCS had a problem with the type of template document and also with Serbian letters such as č, ć, đ, ž, š. The last, but not least problem was when GeoSerbia hacked and after that, GeoSerbia denied access to foreign countries which made it impossible to import any more data on the platform. Agroapps and InoSens solved the problem by redirecting calls from the application through the InoSens server. Further recommendations were provided by the reviewers to be taken into consideration for the service enhancement. However, results were provided to OCS outside of the platform and during the second implementation phase, the service will be run for both iterations. Since organic detection is a relatively new field, Agroapps as technical partner invested further time in learning more about the needs and the existing processes of the Organization. It was important to understand the specifics and details about this production to know how to create a platform and they changed the platform through the project and adapted to OCS requirements. Regarding the service, two outcomes will be provided to OCS, one late in June in order to have an overview of the situation and the final one at the end of the cultivation period.
- OCS performed on-the-spot checks for validation of the product results:
    - On-site inspections of parcels started at the end of April 2022. Most inspections are scheduled in May and June, and several in July. OCS completed almost all field control on the spot in July.
    - 306 organic parcels in 2022 were imported into the platform (crop 2022 - 98% checked on the spot) and 229 parcels for crop 2023 (all parcels checked on the spot in 2023. - 100%).
- OCS has further tested the envision mobile app and provided feedback.
- In parallel, OCS tested and provided feedback on Envision Platform.

Progress on Evaluation Phase

Validation of the Product and Services;

- The results of the first iteration of the product for the distinction between organic and conventional wheat regarding NDVI values were not consistent with the accompanying information provided by OCS.

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- About 50% of organic wheat has typical NDVI curves, while the other 50% has NDVI curves that behave like spring crops. Based on the NDVI values, the indicated crop is possibly a spring crop or a crop other than wheat. When OCS checked this problematic data against historical records, it appeared that all of these plots were declared as winter wheat.
- Regarding to natural humus level, no experience proves that higher percentage of natural humus in the soil was directly the result of the organic activities. The concept behind incorporating soil data into the training dataset was the inverse assumption that high fertility soils are a favourable environment for a farmer to decide to go organic, and only for the part that relates to fertilisation. This assumption presumably won't hold for pesticide use.
- For more accurate analysis it was decided to check spot plots and take soil samples for herbicide analysis and/or to check the correctness of the declared crop type.

- For the latest data product results, OCS provided feedback to the Agroapp (one delivery in August 2022, one delivery in May 2023 and one in June 2023 in csv format through the platform). OCS uses the collected field inspection data to check the validity of the algorithm.
  - In the year 2023. OCS integrated ENVISION service into its own line of business. The inspector uses ENVISION platform for confirming if the crop was organic or not and which crop is declared and application Timestamp with coordinates and the GeoSerbia application confirmed that the inspector was exact on this parcel which was the scope of the inspection. In this way, the inspector confirmed that it is on some exact parcel exact crop with organic farming practices (for example on parcel number 5158 in the cadastral municipality Kanjiža is organic wheat confirmed with ENVISION platform and on the spot).
  - Regarding the mobile application, only the functionality is checked. The mobile application is very user-friendly, but in the concerning of inspection of organic production, it is not very applicable. If there is any suspicion about some exact parcel, a mobile application could be used to take a picture and upload it on the application. The picture provides the application with the geospatial data of the parcel and a timestamp and it confirms the event that occurred on the parcel.
  - The mobile application could be interesting for farmers using, as digital farm books. OCS sends information about the mobile app for all farmers to download. Farmers could use the mobile application as a farm book, but parcels need to be first uploaded to the platform. Control body uses the platform and then farmers can upload pictures and comments on the field.
  - Envision Platform is very easy to use. It could reduce time and effort considering the problematic areas. Reduce the need for additional visits to producers and help to reduce visits to those really needed enabling a helpful tool in risk assessment. It was easily integrated into the existing business system. Can help with this decision-making for recognition of the previous period of implementation of organic rules as a conversion period. There is no such product in the market.

- After co-develop the evaluation criteria and their indicators. The criteria and indicators have been refined and enriched by ILVO through consultation with all BC actors(BC MS3 (D5.3) The Evaluation criteria Developed).
- Defined criteria and indicaters linked with relevant data product and services of the BC.
- OCS participated workshops, and performed questionnaire surveys to evaluate the Envision data products and services and its added business value.

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- For the intermediate evaluation, 2 workshop, and 2 questionnaire surveys (BC MS6 (D5.5) Intermediate report on the evaluation of services).
- For The final evaluation, 1 worksop, to evaluate the Envision data products and services and its added business value (BC MS10 (D5.7) final report on the evaluation of services).

- OCS provided Impact Indicator Values (Baseline-Target-Estimated Values) for impact assessment of the Data Product/services (BC MS6, MS10 (D5.5, D5.7) Intermediate & Final report on the evaluation of services).
- To gather the necessary feedback and insights from farmers on the ENVISION mobile app and Envision services, a workshop was organised. Farmers only downloaded the application (about 40 farmers) and only farmers whose parcels were imported on the platform checked the functionality (13 farmers). OCS at the end of 2021. and in the first part of 2022. interviewed 41 farmers who responded to 47 different questions in a questionnaire survey created by UK Reading, regarding co-design and co-development. Conclusion was that 28 farmers were aware of the benefits of EO technologies and showed the willingness to use it and to be involved in co-design and co-development in such as services.

Collected Feedbacks

During the implementation of the BC, collected feedback for the Serbian BC to monitor the progress of the BC and evaluate the Envision data product and services presented in the table below.

No.	Feedback Report Title	Related Activity No.	Nature	Due Date (DD/MM/YYYY)	Comments
1	Progress report	**A31** Reporting on the Business Cases progress	R	30/04/2022	
2	Progress report	**A31** Reporting on the Business Cases progress	R	30/09/2022	
3	Cyprus BC Progress report	**A31** Reporting on the Business Cases progress	R	31/01/2023	
4	Cyprus BC Progress report	**A31** Reporting on the Business Cases progress	R	31/05/2023	
5	Impact Indicator Values (Baseline-Target-Estimated Values)	**A38:** Provide the Baseline information, if needed	R, S	12/10/2022 10/10/2023	
6	Survey "Evaluation of the business value and acceptance"	**A35**: Provide input to the workshops, events and questionnaire surveys, A26: Providing feedback as we deal with B2C and B2B scenarios.	S	30/O9/2022 10/10/2022	
7	Survey "Evaluation of Performance, Usability And Effectiveness"	**A35:** Provide input to the workshops, events and questionnaire surveys	S	30/09/2022 10/10/2022	
8	20 BC progress meeting	**A27:** Periodically holding meetings and calls at the BC level and prepare and distribute BC level meeting agenda and minutes, **A35:** Provide input to the workshops, events and questionnaire surveys, A26: Providing feedback as we deal with B2C and B2B scenarios	MW	March 2022-October 2023	
9	5 BC Evaluation Workshop	**A37:** Define Evaluation criteria,	MW	March 2022-October 2023	

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		A35: Provide input to the workshops, events and questionnaire surveys, **A26:** Providing feedback as we deal with B2C and B2B scenarios			

Table 30. Serbian BC Collected Feedbacks M19-M36

For the description of the nature, the following options should be used: R - document, report;

DEM - demonstration; MW- meetings, webinars and workshops, S- surveys

Challenges/Risk and mitigation

The main risks identified and difficulties faced by Serbian BC are ssummarised in the table below, along with a brief explanation of how they were managed:

Table 31. Serbian BC Challenges/Risk and mitigation

Declared relevant activity	**Challenges/Risk**	**Solutions/Mitigation**
A3: Developing the business flow (or business logic) within the BC	insufficient number of parcels for testing. Problem is that parcels with different crop types could not be used for testing the platform, only parcels with one crop type on it.	OCS could also inspect some other parcels which are not organic and also test the platform using data for conventional parcels if necessary.
A10: Test the services under various conditions	During the implementation phase, a major problem which does not depend on the Envision project participants is that each parcel must be recognised by the Geosrbija platform in order to be recognised by the Envision platform. Unfortunately, Geosrbija is not fully updated with all the parcels.	For parcels that are not on the Geosrbija platform at any given time, periodic monitoring should take place.
A10: Test the services under various conditions	In the beginning, data could not be imported by different users because of the problem with different versions of Excel. Only one particular computer could be used to import data. This problem was eventually completely solved by changing the configuration of all computers.	OCS found the real cause of the problem was not a version of excel, but it is setting in the computer. In the Control panel in the part of Region (language preferences) in Additional settings in the part of Decimal symbol need to be point (.) and in the part of List separator need to be comma (,).
A10: Test the services under various conditions	Naming of the cadastral municipality in the Envision platform and in Geosrbija is not the same. Envision platform creates ID numbers for each parcel which contains code of cadastral municipality and cadastral number and its sub-number.	Document created (Identification, recognition and monitoring of parcels) on Envision dropbox in the folder 08_WPs\05_WP5_Business cases implementation and evaluation\Serbian BC (OCS) to facilitate the recognition of parcels and stored on a disk that OCS fills with data about cadastral municipality, cadastral number and ID of the platform.
A10: Test the services under various conditions	Template for importing data could`t recognise Serbian letters Č, Ć and Đ, but recognise letters Ž and Š. Almost all cadastral municipality have some of these letters.	The problem was solved by using Libreoffice in the format UTF-8.

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A10: Test the services under various conditions	The most common issues that were faced during this period were about the compatibility with the Geosrbija and the denied access after the hacking incident in the Geosrbija premises. Moreover, inconsistencies were identified in the provided in-situ results with the ones provided by the service.	A communication with Geoserbija was performed to give us access again. However, there was no response from their side. Therefore, InoSens provided a solution that could facilitate the smooth continuation of the pilot implementation. The technical teams of both companies (DRAXIS and InoSens) worked together, and the connection was restored. In order to showcase the inconsistencies of the provided results, the scientific team prepared diagrams depicting the outcomes for both organic and conventional declared crop types growing period in accordance with the respective results from the algorithm. Some of the inconsistencies were due to green mass on the parcels and some others were due to wrong declared crops. Modifications and further analysis were performed and the beta algorithm was presented to the end-users.
A10: Test the services under various conditions	The accompanying information that OCS has provided is NOT in accordance with the NDVI values. About 50% of organic wheat has typical NDVI curves, but the other 50% have NDVI curves like it is some spring species, because regarding NDVI curves harvest happens much later, at least 2 months. The harvest dates are not in agreement with the harvest revealed by NDVI. When OCS checked these problematic data regarding historical documentation on all of these plots was wheat. For OCS, the only explanation was that organic parcels have almost the whole time green mass on parcels, because herbicides are strongly forbidden in organic production and producers need to reduce weeds only by physical removal, which is the biggest challenge in organic production, especially in large areas. The end of August is the time for preparing soil for new crops and new sowing and NDVI see it as the time of harvesting. Also, crops in organic production have a longer green mass than crops in conventional production, because of a higher percentage of natural humus in the soil which is approximately from 1.5 to 2.5, and in organic production is over 2.5. From that perspective, there is a very good correlation and the difference between organic and conventional crops, but how 50% of plots have NDVI curves same as conventional, it could refer to fraud - used herbicides, which is not allowed, or producer (farmer) not declaring the correct crop.	Agroapps and OCS decided that OCS will check on spot parcels and take a sample of soil to analyse on herbicides or check is it that crop which is declared by producer (farmer) when Agroapps reports that the NDVI is different than it should be.
A38: Provide the Baseline information, if needed	For some Indicators, OCS has difficulties in providing baseline data, such as the current number of laws/regulations supporting the technologies for the continuous and	This baseline information will be changed during the project.

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	systematic monitoring of agricultural practices and baseline value regarding using/interacting with the services.	And to facilitate the process, WPL developed a template that offers several options for the data sources and evaluation methods. So baseline information that cannot be collected will be supplemented by expert judgement.
A11: Validate the products and services	The accompanying information that OCS has provided is NOT in accordance with the NDVI values. About 50% of organic wheat has typical NDVI curves, but the other 50% have not.	OCS will visit and control the site where the information that OCS has provided is NOT in accordance with the NDVI values of the product. OCS will continue to provide necessary data to the AgroApps in order to feed and improve the data-products/services and/or upload the necessary data and parcels to the platform
A11: Validate the products and services	Features of the provided products and services are not perceived as useful by end users.	OCS got information through crop growth monitoring which it didn't get anytime before, but the distinction between organic vs conventional farming is still not mature enough. Agroapps and OCS will make an agreement for further collaboration and developing service for distinction between organic vs conventional farming practice.
A12: Integrating, if needed, the services into their line of business.	In Serbia, but also in all other countries, Organic Regulation defined a minimum of one physical control in the year (only one in two years in EU for very low risk operators). This means that all farmers must be controlled on the spot. Organic Regulations still do not recognize any EO service as an approved tool in inspection of organic production.	Envision data products and services can foster the further acceptance of Earth Observation technologies with better accuracy, that the Government can recognize EO technologies for improvement in control and certification of organic production and involve it in existing regulations, such as for CAP.
A3: Developing the business flow (or business logic) within the BC	Problem of enough testing data, generalisation. The inference of models trained on data of other years yielded even worse results. Unfortunately ground truth data on pilot years were scarce, unequally distributed, and with many outliers regarding the crop type. Thus, they were not enough to train year specific models over the pilot seasons.	

Table 32. Serbian BC Challenges/Risk and mitigation

Analyzed Challenges and Lesson Learned

- This was the first time that OCS was included in a project like this (OCS was included only in the testing of pilot thru the project RECAP and as an expert for organic production in the Advisory board in the project Dione). This was the first time that OCS was directly included in co-design and co-developing and directly got the knowledge about EO service and what can be the purpose of them. OCS started very enthusiastically with developing services, because of lack of knowledge about EO technologies. First expectations was that EO technologies could detect the use of not allowed inputs directly on the field, but this is still impossible. Through the development of service and through the project, OCS gained valuable knowledge and understood how EO technologies can help in the process of inspection of organic production and help for decision making.

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- The rapid resolution of challenges and risks is ensured by effective cooperation of technical partners and CB in mutual pursuit of better data products quality.
- Continuous supervision and useful additional tools for risk assessment could reduce the possibility of fraud in agriculture. Inspection and certification process in the current regime is very time consuming and any decrease is very valuable. Envision services increase productivity providing a helpful tool in risk assessment, but Organic Regulations still don't recognize EO technologies as tools for inspections.
- If we get historical data for parcels that are not in our system (for newly involved parcels) it will have a very favourable effect, especially for cases of recognition of the previous implementation of organic rules. The conversion for organic production is 2 or 3 years, depending on the plant species, but if in the last 3 years there was a meadow or pasture where no agrotechnical work was performed, the certification body can approve a recognition of previous implementation of organic rules (shortening of the conversion period). Envision service can help with this decision-making.
- In inspection of organic production Envision service can help with detection of parallel production (the same crop type in organic and conventional production) which would save time for inspection of all conventional parcels only to check what plant species are in those plots using Envision service for checking instead of spot checking. For this step we used crop growth monitoring vegetation status of data products. We didn't find any irregularity, because all included farmers in the project are fully organic, but OCS sees perspective for this, because Envision service can be used in the whole country and for all crops, not only for these 4 crops which are used for testing the platform.
- Currently none of the Laws/regulations support the technologies for the continuous and systematic monitoring of organic agricultural practices. In Serbia, but also in all other countries, Organic Regulation defined a minimum of one physical control in the year (only one in two years in EU for very low risk operators). This means that all farmers must be controlled on the spot. Organic Regulations still do not recognize any EO service as an approved tool in inspection of organic production. Envision data products and services can foster the further acceptance of Earth Observation technologies with better accuracy, that the Government can recognize EO technologies for improvement in control and certification of organic production and involve it in existing regulations, such as for CAP.
- Through the project, in the first phase 8% of small parcels , and 35% elongated parcels were excluded for machine learning. Utilising higher-resolution images is a potential solution for these cases. More than 500 parcels with more than one crop type on the plot, not even considered for machine learning and also after that for validating the platform. Solution for this can be clear demarcation of the border of plant species on the plot, but this is very difficult.
- Also, parcels that have no updated data on GeoSerbia could not be used, but this solution is just waiting for an update from GeoSerbia. OCS is in direct contact with GeoSerbia and can provide data information to GeoSerbia for parcels which are not updated on their platform.
- Different crop types for developing biodiversity in organic production and physical damage of weeds without use of herbicides, lead to the presence of natural vegetation, posing an additional challenge for classification.
- Farmers should begin making declarations as early as possible to ensure the meaningful utilisation of the results.

Result

The data product **"Crop growth monitoring Vegetation status"** is designed to understand the distribution of crop types on arable land. It provides data-driven insights into the types of crops cultivated in specific fields, aiding inspectors in confirming compliance with the declared crop type.

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The algorithm utilises spectral signatures, temporal data and crop growth models to accurately identify and map the types of crops being cultivated on arable land. OCS shared the timetable of in-situ data collection and scheduled on-the-spot checks with technical partners to have a full picture of these results validation. As a result, an algorithm was developed that plays a significant role in checking the accuracy of crop declarations and assessing compliance with regulatory requirements, such as adequate crop rotation, existing of parallel production, possibility for decision making for recognition of previous implementation of organic rules (shortening of the conversion period).

The data product **"Distinction of organic vs conventional farming practices"** is still not mature enough. Results from 2022. and 2023. were with great accuracy. In 2022. Agroapps provided to OCS results from 44 parcels with organic maize, 58 parcels with organic soybean, 85 parcels with organic sunflower and 119 parcels with organic wheat. Percentage of classified organic pixels that were actually declared as organic was 100% for maize, 98.5% for soybean, about 99% for sunflower and over 99% for wheat**.** In 2023. Agroapps provided to OCS results from 139 parcels with organic wheat. Percentage of classified organic pixels that were actually declared as organic was about 99%. This was a helpful tool in risk assessment and OCS decreased risk for one operator with more than 2000 ha and with a long distance which caused it that additional inspection is not needed anymore. Unfortunately, this is only appropriate for one farmer and too many plots needed to be excluded from validation. Problem was because of not enough testing data, generalisation. Agroapps and OCS will make an agreement for further collaboration and developing service for distinction between organic vs conventional farming practice.

Milestones

The milestones that have been achieved for the Serbian BC are shown in the table below.

Milestones No	Milestone Name	Achievement (yes/no)	Achievement Date	Mean of verifications
BC M1	Deployment of the first version of the services.	Yes	End of Feb	The initial version of data products is delivered. (D3.4)
BC M2	BC level meetings, workshops and technical support.	Yes	End of May	Regular meetings, workshops and technical support organised.
BC M3	Define Evaluation criteria	Yes	End of Jun	The Evaluation criteria Developed (D5.3)
BC M4	BC level meetings, workshops and technical support.	Yes	End of Sep	Regular meetings, workshops and technical support organised
BC M5	Intermediate business case implementation report	Yes	End of-Oct	Intermediate business Case implementation report (D5.4)
BC M6	Intermediate evaluation report.	Yes	End of Oct	Intermediate report on the evaluation of services (D5.5)
BC-M7	Delivering improved /updated Envision Data product and Services though the platform.	Yes	End of Dec (delay for the Serbian BC: in June 2023)	The improved /updated Envision of Data product and Services delivered.

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BC M8	BC level meetings, workshops and technical support.	Yes	End of May 2023	Regular meetings, workshops and technical support organised
BC M9	Final business case implementation report	Yes	End of Jun 2023 (postponed to the end of October, due to the project's extended timeline)	Final business case implementation report (D5.6)
BC M10	Final evaluation report	Yes	End of Jun 2023 (postponed to the end of October, due to the project's extended timeline)	Final report on the evaluation of services (D5.7)

Table 33. Serbian BC Milestones

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3.5 UK trial audit study

Generic Information

UK trial audit study			
Organisation	LEAF	***Type of organisation:***	Environmental Assurance
Facilitator	Abbey Holman		
Description:	The UK BC will investigate the role of EO in environmental assurance schemes. The ENVISION services were planned to apply by LEAF within LEAF Marque auditing to test their potential for assessing compliance with a number of control points within the LEAF Marque Standard. A trial audit pilot study will take place to perform this assessment.		

Table 34. Generic information of UK Trial Audit Study

LEAF Marque is an environmental assurance system, showing that food has been grown sustainably with care for the environment. It requires LEAF Marque certified businesses to have a number of plans and policies in place for successful implementation of Integrated Farm Management.

As part of the ISEAL Alliance (the global membership association for credible sustainability standards), LEAF Marque, along with other ISEAL members, look to explore the ways to increase the effectiveness and efficiency of sustainability standards and identify opportunities for innovation that increase the uptake of credible standards. As part of this work a push for a more outcomes-based hybrid approach has been identified and ENVISION provides an opportunity to access a number of LEAF Marque control points by their outcome and increase the transparency of the auditing process.

Currently LEAF Marque is audited through a yearly inspection which includes checking compliance against every control point in the LEAF Marque Standard including checking farmer management plans, the implementation of Integrated Farm Management practices, monitoring and recording activities and communication with staff and the general public.

LEAF involved in WP5 activities to understand how the ENVISION services could be used to improve and innovate the auditing process and allow the LEAF Marque Standard to monitor how LEAF Marque certified businesses are implementing sustainable farming in accordance with the LEAF Marque Standard. They had the potential to enhance the efficiency of the auditing process, potentially reducing audit costs for certified businesses and certification bodies.

After the end of the project, LEAF will explore the possibility of incorporating EO data and knowledge generated from ENVISION into the requirements of the LEAF Marque Standard and assurance process.

Description

As part of Task 6.5 'Contribution to Standards', LEAF conducted a trial audit to assess the potential for ENVISION services to verify farm compliance with the requirements of the LEAF Marque Standard. The findings from this trial audit informed ENVISION's strategy to engage with environmental assurance systems. It ealso informed LEAF's approach to incorporating EO into the LEAF Marque assurance system.

The trial audit was conducted with a LEAF Marque certified farm, RB Organic Ltd., located in the eastern region of the United Kingdom. The trial audit monitored five parcels growing organic carrots and one parcel growing organic potatoes. Whilst LEAF Marque audits are conventionally conducted by third party certification bodies, for research purposes of the trial audit, LEAF performed the monitoring role of a certification body. The trial audit was originally scheduled to run for 12 months, however, there were limiting factors that reduced the trial audit monitoring to a two-month period. The farm was delayed in confirming their participation in the trial and providing the farm data that was required to begin the monitoring, due to a busy growing season and changes in the personnel allocated to

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collaborate with the ENVISION project partners. Further, technical challenges with uploading the farm data to the ENVISION platform due to the ShapeFile format of the data caused additional delays. DRAXIS were able to resolve the technical issues to upload the farm data. The trial audit monitoring then occurred in January and February of 2023.

Objectives;

The objectives of the trial audit were to assess the extent to which the ENVISION can be used to monitor farm compliance with requirements in the LEAF Marque Standard.

Identified a product usage scenario (service business logic) and testing process

From the beginning of BC implementation (March 2022), LEAF has participated in WP5 BC Implementation activities to investigate the role of EO in environmental assurance schemes.

- LEAF assessed applicability of the ENVISION services within LEAF Marque auditing to understand their potential for assessing compliance with a number of control points within the LEAF Marque Standard. A trial audit pilot study took place to perform this assessment.
- The specific objective is to assess the feasibility of incorporating EO into the LEAF Marque certification and auditing process, including identifying opportunities and barriers to implementation and evaluating the robustness of using EO to verify compliance with the LEAF Marque Standard.

Progress on Implementation Phase

- Since 01/03/2022, four Progress Reports were submitted: (April 30th 2022, September 30th, 2022, January 31st 2023, May 31st, 2023)
- During the different steps of the implementation process, all BC partners worked in close collaboration.
  - Until now, 20 BC meetings have been held
- Technical support and information for data collection, use and testing of services were also provided as a part of regular meetings together with the documentation produced by AgroApps.
- Data and Information are exchanged to support trial audit study through monthly meetings and through the documentation produced such as;
  - Brief description regarding services (Analytics on Vegetation and Soil Index Time-Series and Crop growth monitoring) logic and information on needed data, provided by AgroApps.
  - LEAF Marque Business Case and Feasibility Background paper has been provided which gives overview of the roles and flow of information related to LEAF Marque assurance and certification and describes the feasibility considerations to incorporate ENVISION services into the LEAF Marque certification process by LEAF.
- LEAF participated in workshops and performed questionnaire surveys to evaluate the potential of the Envision data product and services and its added business value.
  - For the intermediate evaluation, 2 workshops, and 2 questionnaire surveys (BC M4, BC MS6, BC MS8).
- LEAF participated in workshops and completed surveys during the November 2022 project partner meeting to provide feedback on the co-production process. Results will be provided within D2.7.

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- LEAF determined it could not use vegetation status data to measure compliance with the LEAF Marque control points used in the trial audit, therefore there is no longer a need for the historical vegetation status data. This is because the control points selected were primarily related to parcel boundary/margin management.
- LEAF has alternatively identified new control points and relevant ENVISION services to test in potential future case studies in the UK or EU with LEAF Marque certified farms. LEAF are currently investigating potential farm cases that could be appropriate for testing the control points and Envision services. Before conducting new case studies, LEAF would collect the historical data required to use the Envision services for these studies, so that it could use and test a wider range of services, because the current lack of historical data has impacted LEAF's ability to test services in the Envision project. This would enable the testing of a wider variety of control points in the LEAF Marque Standard in addition to the wider range of services.LEAF will need to liaise with developers to determine what specific historical data needs to be recorded in order to use and test the Envision services.
- LEAF completed the trial audit (February 2023)
- LEAF carried out stakeholder interviews and a survey to gather data on the feasibility of incorporating EO into environmental assurance systems (December 2022 – January 2023)
- LEAF conducted an in-depth review of the LEAF Marque Standard version 16.0 (new version of the Standard effective April 2023) and research to identify new outcome-based requirements for the standard that could be monitored using EO and Envision services (March – May 2023)
- LEAF completed a report to summarise the findings of the trial audit and feasibility study (June 2023), including that additional trials are necessary to test the services to enable the use of more services and understand how they can monitor environmental outcomes and compliance under various conditions (different regions and production systems)
- LEAF has alternatively identified new control points and relevant Envision services to test in potential future case studies. LEAF would collect data for these future studies, so that it could use and test a wider range of EO services, because the current lack of historical data has impacted LEAF's ability to test services during the UK BC in the Envision project.
- In May 2023 LEAF collected feedback from the farm participating in the trial audit, about the platform and the use of EO in environmental assurance.
- LEAF evaluated the results of the trial audit and feasibility study (June 2023), including that additional trials are necessary to test the services to enable the use of more services and understand how they can monitor environmental outcomes and compliance under various conditions (different regions and production systems).

Results and Lessons Learned

The results of the LEAF trial audit demonstrate that several elements of the LEAF Marque assurance system require significant modifications in order to adequately integrate the ENVISION services for compliance monitoring. LEAF, and the certification bodies that conduct LEAF Marque audits, do not collect and store the necessary data to enable the use of ENVISION services through the platform.

This not only limited LEAF's ability to conduct extensive testing and validation of the services but also the number of LEAF Marque requirements that could be monitored in the trial audit. This is likely a representative limitation that other environmental assurance systems would experience if they do not already collect the necessary data or utilise EO in their systems.

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Because LEAF could not properly test the services, a remote visual monitoring approach (CAPI) was used to assess compliance. However, the results highlighted the limitations to assessing compliance with this approach, especially monitoring for signs of soil degradation due to the lack of granularity and resolution of the image at the maximum magnification level, which reduces LEAF's ability to understand the effectiveness and suitability of the farm's soil management practices. Based on the findings from the trial audit and the identification of new requirements that could be added to the LEAF Marque Standard to be monitored by ENVISION services, it would be necessary to modify the LEAF Marque assurance system so that LEAF could conduct new case studies. LEAF would be primarily interested in testing the following services in order to assess LEAF Marque certified farm compliance:

- cultivated crop type map to verify crops grown for certification
- Soil Organic Carbon to monitor the effectiveness of soil conservation and carbon sequestration practices
- Vegetation Status Mapping to take into account when assessing nutrient applications/efficiency

System changes would include modifying the LEAF Marque Standard requirements, processes for our internal assurance system, processes for the certification and auditing protocols for LEAF Marque certification bodies and potentially updating electronic systems to enable the collection and storage of the historical data required to use the ENVISION services.

In addition to system modification, LEAF and its certification bodies would need to dedicate resources to building technical expertise on earth observation technology and its application within assurance systems. Due to the amount of time required to implement the required system modifications and conduct additional test case studies, and the limited amount of time remaining in the ENVISION project, these required next steps for LEAF would fall out of the scope of the project, and thus would need to occur after the conclusion of the ENVISION project. LEAF has identified new control points and relevant ENVISION services to test in potential future case studies in the UK or EU with LEAF Marque certified farms. LEAF are currently investigating potential farm cases that could be appropriate for testing the control points and ENVISION services. LEAF are also investigating what projects are occurring or planned within England's Department for Environment, Food and Rural Affairs' (Defra) Earth Observation Centre of Excellence (EOCE). There may be potential crossovers and collaboration opportunities with future LEAF Marque case studies to use ENVISION services to assess farm compliance with the LEAF Marque Standard and alignment with other sustainable farming frameworks monitored by the Rural Payment Agency.

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3.6 Lighthouse Customers

During the implementation phase, some organizations expressed interest in ENVISION Data Products and Services. However, they made the deliberate choice not to engage as full-fledged Business Cases, where the products and services undergo implementation and testing. This decision was motivated by a range of factors, including their lack of conviction in the project, having access to better alternatives, budget constraints, time limitations for follow-up, or the absence of necessary conditions for their involvement. With the flexibility we created, some of them still had the opportunity to participate in the project as evaluators.

However, through the flexibility offered, some of these organizations continued to engage as BC evaluators (see Section 1.5). They provided valuable additional insights and feedback through demonstrations and project events, thereby contributing to the further improvement of the ENVISION project's outcomes. This allowed them to be involved in a way that suited their preferences and resources, while still contributing to the success of the project.

Lighthouse Customers	Input
Greek Paying Agency, OPEKEPE	**Data Products and Services: Crop classification, Grassland/ mowing detection, Mobile Application** OPEKEPE was actively involved during the project as part of the LHC Group. They provided feedback with regards to crop classification, grassland/ mowing detection as well as for the mobile application. Specifically, the provided input regarding the issue of crops that are located in small, elongated parcels. A proposal was "if the number of the available small parcel is not sufficient to create a balanced set, then bigger plots will be used to acquire a training dataset of an adequate size". Furthermore, since they were users of SEN4CAP products they also provided feedback with regards to the algorithm and the needed training data. Lastly, the mobile application was tested from OPEKEPE, through Cypriot and Lithuanian accounts. The level of satisfaction was very high, but further improvements have been requested, such as navigation to the parcel, integration with governmental portal for the authentication of user account and development of a farm calendar. A recommendation that was taken into consideration was the presentation of all the declared parcels per year and record history of the notifications/ notes.
Inspection Institute for Organic Products "BIO Hellas" (BIO)	**Data Products and Services:** Distinction of Organic Farming Practices, Crop Classification BIO monitored the Serbian business case and the evolvement of the distinction of organic farming practices. Based on the outcomes, they provided feedback on how this service would be adapted into the Greek market. One of the most important types of feedback was the need for the combination of crop classification and distinction of organic

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	farming practices, as well as the clear depiction and measurement of the parcels boundaries, especially in the cases that the neighbour parcel are under conventional farming practices.
Inspection and Certification Organisation TUV Hellas	**Data Products and Services:** Distinction of Organic Farming Practices, Crop Classification TUV provided with constant feedback on how the inspections are performed for organic cultivations and what parameters are taken into consideration during the inspections in correlation with Serbian pilot case. One of the main concerns that TUV, BIO and OCS stated was that they need results before the end of the cultivation period. Therefore, the service provided results in two periods, in the mid of the cultivation period, in order to facilitate the CBs with the inspections and at the end of the cultivation period. TUV mentioned that they need an application that could keep history of all the actions performed and they expressed their interest in the mobile application.
Agricultural Chamber – Institute Murska Sobota	The Agricultural Chamber – Institute Murska Sobota is interested to potentially incorporate the following services into the Farm Manager service. Therefore, during the meetings they provided comments and recommendations from advisors/ farmers' perspective. Specifically, **Cultivated Crop type maps:** The main need is for the user to be able to allow a quick overview of specific business planning input data (real-time and historical identification of cultivation per specific land parcel). **Analysis on vegetation and soil index time series:** The requirement is to support farmers in comparing vegetation indexes and provide initial insight into the full-scale service.

Table 35. Involved Lihthouse Custumers

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3.7 Key Performance Indicators

In reviewing the KPI table, it is evident that the project has made substantial progress in several areas. Notably, the business cases for ENVISION Data Product and Services at the pre-operational stage have seen positive developments in Lithuania, Cyprus, Belgium, and Serbia. The ENVISION mobile app has gained traction, particularly in Lithuania and Cyprus. Additionally, feedback on the usefulness of ENVISION EO-based services has been encouraging, with a 90% positive response rate.

Key Performance Indicators (KPIs)	Target values	Achieved
Business Cases of the use of ENVISION toolbox of services at pre-operational stage	15	6 (Lithuania, Serbia, Flanders, Cyprus, UK and Flanders testing grassland mowing)
270 Beneficiaries receiving agricultural subsidies monitored through business cases	100 in Lithuania	Yes (more than 1.000.000 parcels have been imported and monitored through the implementation phase)
	40 in Cyprus	Yes (more than 400.000 parcels have been imported and monitored through the implementation phase)
	20 in Belgium	Yes
	80 in Serbia	Yes (more than 300 parcels have been imported and monitored through the implementation phase)
240 Farmers using the ENVISION mobile app	100 in Lithuania	109
	40 in Cyprus	20
	20 in Belgium	10
	80 in Serbia	40
Certified farmers monitored through business cases (Serbia)	100	Yes (more than 300 parcels have been imported and monitored through the implementation phase)
Expected Impact – Assessment indicators		
Acceptance of the proposed services by PA	90%	90%
Acceptance of the proposed services by CB	90%	80%
		70%
Acceptance of the Add-on Development tool	80%	90%
Feedback from trials on usefulness of ENVISION EO based services	Positive > 90%	90%
Number of LHCs retaining ENVISION following validation	3	4 (Greek Paying Agency, BIO Hellas, TUV Hellas, Agricultural Chamber – Institute Murska Sobota, D1.7)

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LHCs acceptance of ENVISION	90%	85%

Table 36: Key Performance Indicators (KPIs) for Objective 3

4 Conclusions

The "Final BC Implementation Report," D5.6, is based on information collected from 20 progress reports (4 from each Business Case) that reflect the current status and progress of implemented activities. This information was gathered through regular progress meetings, emails from WP5, and submitted progress reports.

From the collected data, it's evident that substantial progress has been made since the beginning of the implementation phase (M19). However, certain Business Cases encountered challenges and delays in meeting specific milestones for their activities and deliverables. They've identified the causes of these delays, developed plans with adjusted schedules, and allocated additional resources to address these issues. Importantly, as a result of the measures taken, they managed to submit their progress reports on time and meet their deliverables and milestones within the designated implementation period.

Furthermore, effective communication and cooperation among the BC partners have played a pivotal role in ensuring the required maturity of services to meet the specific needs of BC customers. This collaboration has allowed for the anticipation of challenges, constraints, potential roadblocks, and taking timely measures to ensure a smooth implementation.

In summary, achievements within Cyprus BC have been a success and demonstrate the clear value of ENVISION DP1 and DP2 products. Innovation was fueled by overcoming challenges such as the harmonization of agricultural declarations and the handling of complex land geometries. Although BC customers have a positive view of the integration of ENVISION data products after the project ends, they stress the importance of challenges such as procurement processes and budget constraints in the public sector that could affect the use of these products after the project ends.

In Lithuania, the implementation of data products (DP1, DP2, DP2) and services to meet the needs of the Common Agricultural Policy (CAP) proved to be very useful. Challenges related to data accuracy were effectively addressed through cooperation with domain experts. The data products have shown significant potential for added value by preventing penalties, reducing workload and improving decision-making, which is an important step toward achieving CAP objectives in Lithuania. It is also important to note that post-project data product integration requires a public procurement process.

BC Flanders highlights the importance of accurate soil sampling and the use of additional lab measurements. It delivered two key data products: soil quality maps at pixel and parcel levels. This innovative service makes it possible to continue large-scale, low-cost monitoring of soil quality using topsoil organic carbon (TopSOC) indicators extracted from machine-learning models that take into account soil pedoclimate conditions. This can benefit farmers and policy makers, support environmental objectives and help adjust policies in Flanders based on soil insights. The developed product will be used as a baseline within then Flemish Soil Passport in a way to allow the relative SOC monitoring as presented at the AgriTEF day.

The implementation and integration of DP5 into Serbia's organic production inspection brought both achievements and challenges. OCS gained insights into EO technologies but faced challenges, including the lack of legal support for EO tools and data accuracy concerns. Moving forward, the focus is on securing EO technology recognition in organic regulations, refining the "Distinction of organic vs

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conventional farming practices" service with Agroapps, and addressing data challenges to enhance organic production inspections, with the goal of bolstering inspection accuracy and efficiency.

In summury, BC customers (PA) are positive about the end products, but there are steps to overcome for the ability to buy and use ENVISION products after the project. This relates to the organizational structure and the procedures that need to be followed for public procurement.

The varying accuracy of the same data products, developed by the same developer, can be attributed to several factors. First and foremost, it underscores the significance of having experience both as a user and as a provider of data and feedback. This experience enables a more precise and efficient definition and explanation of the specific needs and requirements. Additionally, familiarity with similar technologies enhances the ability to offer more effective feedback, drawing from past experiences to determine what works and what doesn't.

Furthermore, it's essential to recognize that ecological differences, as well as the complexity and size of the sites where these products are applied, play a crucial role in shaping the overall quality and maturity of these products. These environmental and contextual variations can significantly impact the performance and accuracy of the data products, highlighting the need for a nuanced understanding of the specific conditions in which they are deployed.

During the project's lifetime, five data products and the services of the mobile app and ENVISION platform were developed and tested to support their market readiness. All the progress reports submitted by the Business Cases clearly demonstrate the innovative potential of ENVISION products and services to bring commercial and market value.

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5 Annex

5.1 Actors of the WP5

No	Name (Short name)	Participation in Tasks and Business Cases
1	DRAXIS Environmental (DRXS)	Participate in the planning and implementation phase of the Business case and contribute to Task 5.4 Add-on development showcase and capacity building.
2	National Observatory of Athens (NOA)	Participate in the planning and implementation phase of the Lithuanian and Cypriot Business case.
3	National Paying Agency (NPA)	Responsible for the Lithuanian business case (Monitoring multiple environmental and climate requirements of CAP)
4	Flemish Department of Agriculture and Fisheries (LV)	Responsible for the Belgium Business Case (Monitoring the condition of the soil)
5	Organismos Agrotikon Pliromon (CAPO)	Responsible for the Cypriot Business Case (Monitoring multiple environmental and climate requirements of CAP)
6	Doo Organic Control System Subotica (OCS)	Responsible for the Serbian Business Case (Monitoring organic farming practices)
7	Eigen Vermogen Van Het Instituut Voor Landbouw – En Visserijonderzoek (EV ILVO),	WP Leader and Task Leader in 5.1-5.2 and 5.3.
10	ITC - Innovation Technology Cluster Murska Sobota (ITC)	Leader of Task 5.4 Add-on development showcase and capacity building.
12	INOSENS Doo Novi Sad (INOS)	Participate in the planning, implementation, and evaluation phase of the Serbian and UK (LEAF) Business case and contribute to the Add-on development showcase and capacity building.
13	AgroApps I.K.E (AgroApps),	Participate in the planning, implementation, and evaluation phase of the Serbian Business case and contribute to the Task 5.4 Add-on development showcase and capacity building.
14	Linking Environment And Farming (LEAF)	Responsible for the UK business case focusing on LEAF Marque Certification and how EO data could be used to improve the accreditation process.

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5.2 Role descriptions

Role ID	Role Name	Role Short Description (underline verbs highlight the major activities)
R1	Work Package **Leader** (WPL)	Responsible for managing the WP activities and supporting the implementation of the Business Cases. WPL also defines the Business Cases, assigns roles and supports the evaluation of the ENVISION data products and services. They collaborate closely with the Facilitators and the WP partners.
R2	Business case **Facilitator** (BCF)	Facilitates Business Use Cases, supporting efficient communication and collaboration between the Consumers, the Providers and the End Users. Depending on the complexity of a business case, a Facilitator can act as a Consumer or as End Users or a Data Provider.
R3	Product & Service **Consumers** (PSC)	A PSC can actively participate in the co-production of the ENVISION products and services, test them under various conditions and validate them within the Business Cases. A PSC can participate in one or many Business Cases. A PSC also integrates, if needed, the services into their line of business as a way to develop the business flow. A PSC may also act as an end-user when the end-users are actors within the same organisation. A PSC also acts as the primary BC Evaluator.
R4	**Service Provider** (SP)	An SP develops and delivers services for the implementation of the Business Cases. They also improve the services using feedback coming from the Consumers and the End Users.
R5	**Platform Provider** (PP)	A PP develops and delivers the Envision Platform and its tools by using suitable techniques and technologies. The SP delivers their services through the Envision Platform. The PP updates the platform using the collected feedback from the Consumers, End Users and the Data and Service Providers.
R6	**Data Provider** (DP)	DPs identify, collect, integrate, and validate all available ancillary data sets to feed ENVISION's products and services. Service Providers use the data resources that come from the Data Providers to deliver their services.
R7	**End Users** (EnU)	EnUs ultimately use the service (or the product) within a Business Case, for example, the Farmers or Agronomists. An EnU also acts as the primary BC Evaluator.
R7	**BC Evaluators** (BCE)	BCEs evaluate the business cases and their added value. This role is performed mainly by the Consumers and the End Users; however, providers may participate as evaluators providing their feedback as we deal with B2C and B2B scenarios.

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5.3 BC Work Plan (BC progress report template)

Name of the Business Case					
Business Customer:				*email*	
Business case Facilitator				*email:*	
BC Description:	.				
Specific objectives					
Implementation area					
Service					
Data Products					
BC Partners					
Partners Role					

Work Plan							
Operational Phase	**Activity Group 1 Use and test the ENVISION products and services within the BC.**	**Objective**	The overall goal of this group is to validate and evaluate the data product and services to improve and demonstrate that the services meet market needs in a cost-effective manner				
		Short description	Under this group, key activities will take place. First, the business flow for the process will be defined to use and test the product's and service's capability and reliability in fulfilling the needs of organizations to monitor sustainable agricultural practices. In some cases, along with their current workflow, the services will be integrated into their business line and/or systems.				
		Activities	***Partners involved***	***Milestones***	***Status of Execution - performed work -/ Changes, Achievements and Improvements***	***Adverse developments during the execution, challenges/ Potential Risks***	***Suggestions for solutions/ Risk mitigation***
		A3: Developing the business flow (or business logic) within the BC					
		A10: Test the services under various conditions					

		A12: Integrating, if needed, the services into their line of business.					
		Other relevant work performed					
	Activity Group 2 **Provide efficient communication and collaboration between the Consumers, the Providers and the End Users.**	**Objective**	Establish and strengthen cooperation and communication between Project partners and BC actors and facilitate coordination of BCs.				
		Short description	To achieve the objectives of this activity group, meetings will be organized with the BC actors during the implementation phase and the necessary documents will be prepared (agenda and minutes). The WPLs and project management will be kept informed through regular monthly progress meetings and/or other communication tools defined in D5.1.				
		Activities	***Partners involved***	***Milestones***	***Status of Execution - performed work / Changes, Achievements and Improvements***	***Adverse developments during the execution, challenges / Potential Risks***	***Suggestions for solutions/ Risk mitigation***
		A27: Periodically holding meetings and calls at the BC level and prepare and distribute BC level meeting agenda and minutes.					
		A36: Periodically Updating WP and project partners with a meetings and calls					
		A2: Supporting the implementation of the BC by providing necessary technical instructions with technical sessions and webinars.					
		Other relevant work performed					
	Activity Group 3 ***Gathering Feedback and reporting***	**Objective**	Ensure continuous evaluation and monitoring for each BC. Establish a bottom-up approach to problem-solving.				
		Short description	This group will focus on the organizational activities needed for feedback collection and the periodic feedback reporting, both for evaluation of the Envision data product and services and for monitoring the BC implementation progress, either through documentation or by providing input in organized workshops and demonstrations.				
		Activities	***Partners involved***	***Milestones***	***Status of Execution - performed work / Changes, Achievements and Improvements***	***Adverse developments during the execution, challenges / Potential Risks***	***Suggestions for solutions/ Risk mitigation***

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		A31: Reporting on the Business Cases progress					
		A34: Organizing internal and/or external demonstration activities and workshops.					
		A35: Provide input to the workshops, events and questionnaire surveys					
		A26: Providing feedback as we deal with B2C and B2B scenarios.					
		Other relevant work performed					
Evaluation Phase	**Activity Group 4 Evaluate the business cases and their added value**	**Objective**	Evaluate the performance, usability and effectiveness of the products and services and their economic, environmental and social impacts in the implementation of the BC				
		Short description	This activity group will include specific activities needed for a successful evaluation. First, we will define the criteria and determine the structure and tools. Second, we will focus on data collection by using determined tools such as questionnaires, interviews and regular meetings to analyze the data and document the findings.				
		Activities	***Partners involved***	***Milestones***	***Status of Execution - performed work / Changes, Achievements and Improvements***	***Adverse developments during the execution, challenges / Potential Risks***	***Suggestions for solutions/ Risk mitigation***
		A37: Define Evaluation criteria					
		A38: Provide the Baseline information, if needed					
		A11: Validate the products and services					
		Other relevant work performed					

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Provided Data/information by Business case customer to the Services Provider

Short description of Data/information	Focused Crop type	Focused Area (location-size)	Data- format	Related data product/s	Related activity	Purpose of the data/information provided

Feedback collection

Feedback Reports No.	Feedback Report Title	Activity No.	Nature	Due Date (DD/MM/YYYY)	Comments
1	BC Progress report	A31	R	30/04/2022	
2	BC Progress report	A31	R	30/09/2022	
3	Serbian BC Progress report	A31	R	30/01/2023	
4	Serbian BC Progress report	A31	R	31/05/2023	

For the description of the nature, the following options should be used: R - document, report; DEM - demonstration; MW- meetings, webinars and workshops.

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Guidance for filling in the template

Business Case: *Code*	*Title*		
Business Customer:	*Potential future customers of Envision services,* *-Paying Agencies using ENVISION to monitor environmental and climate requirements of EU policies related to agriculture* *-Certification Bodies using ENVISION to monitor organic farming requirements*	***email:***	
Business case Facilitator	*Person responsible for supporting communication and collaboration*	***email:***	
BC Description	*Short Description of the BC*		
Specific objectives	*Brief explanation of BC objectives*		
Implementation area	*The spatial coverage of the products (National, Regional, local) within pilot sites.*		
Service	*Envision services that will be tested and validated in BC by PSC*		
Data Products	*Data Products developed for Envision services*		
BC Partners	***Short name of the Partners involved in BC Work Plan***	***Short Name***	***Short Name***
Partners Role	*Partners roles as those defined in D 5.1*		

ork Plan

Operational Phase	**Activity Group 1** **Title of the activity group**	**Objective**	*Short description of the specific objectives which this Activity group aims to achieve.*			
		Short description	*Short description of activity groups; Describe the specific steps or actions that will take place to achieve the objectives of this activity group*			
		Activities	***Partners involved***	***Milestones***	***Status of Execution- performed work / Changes, Achievements and Improvements***	***Adverse developments during the execution, challenges / Potential Risks***	***Suggestions for solutions/ Risk mitigation***
		Name of the activity	*Partners involved in this particular activity*		*A brief overview of the status of the activity group; provide updates and an assessment of the progress of activities against the work plan: Are activities running ahead or behind schedule?*	*Describe during the implementation phase any major issues that have arisen or might be arisen during the progress: possible critical risks, uncertainties, and difficulties associated with the execution of the activities*	*Describe your proposed measures/strategy/ actions for addressing them to ensure a smooth implementation process.*

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BC General Gantt chart

BC General Gantt chart

Phase		Activities	Partners involved	2022 Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2023 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Operational Phase	Activity Group 1	**Use and test the ENVISION products and services within the BC .**		M1										M7								
		A13 Developing the business flow(or business logic)within the BC																				
		A10 Test the services under various conditions																				
		A12 Integrating, if needed, the services into their line of business.																				
	Activity Group 2	**Communication and collaboration between the Consumers,the Providers, the End Users**					M2				M4								M8			
		A27:Holding meetings and calls at the BC level and prepare and distribute BC level meeting agenda and minutes.																				
		A36: Periodicly Updating WP and project partners with a meetings and calls																				
		A2: Supporting the implementation of the BC by providing necessary technical instructions with technical sessions and webinars.																				
	Activity Group 3	**Gathering and Reporting Feedback**										M5								M9		
		A31: Reporting on the Business Cases progress																				
		A34: Organizing internal and/or external demonstration activities and workshops.																				
		A35: Provide input to the workshops, events and questionnaire surveys																				
		A26: Providing feedback as we deal with B2C and B2B scenarios.																				
Evaluation Phace	Activity Group 4	**Evaluate the business cases and their added value**						M3				M6								M10		
		A37: Define Evaluation criteria																				
		A38: Provide the Baseline information, if needed																				
		A11 Validate the products and services																				

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BC Milestones

Milestones No	Milestone Name	Due date	Mean of verifications
BC M1	Deployment of the first version of the services.	End of Feb	The initial version of data products is delivered. (D3.4)
BC M2	BC level meetings, workshopsand technical support.	End of May	Regular meetings, workshops and technical support organized.
BC M3	Define Evaluation criteria	End of Jun	The Evaluation criteria Developed (D5.3)
BC M4	BC level meetings, workshops and technical support.	End of Sep	Regular meetings, workshops and technical support organized
BC M5	Intermediate business case implementation report	End of-Oct	Intermediate business Case implementation report (D5.4)
BC M6	Intermediate evaluation report.	End of Oct	Intermediate reportbon the evaluation of services (D5.5)
BC M7	Delivering improved Envision Data product and Services though the Platform.	End of Dec	The improved Envision of Data product and Services delivered.
BC M8	BC level meetings, workshops and technical support.	End of May 2023	Regular meetings, workshops and technical support organized
BC M9	Final business case implementation report	End of Jun 2023 (postponed to the end of October, due to the project's extended timeline)	Final business case implementation report (D5.6)
BC M10	Final evaluation report	End of Jun 2023 (postponed to the end of October, due to the project's extended timeline)	Final report on the evaluation of services (D5.7)

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End of Document

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