D5.8 ADD-ON DEVELOPMENT SHOWCASE AND CAPACITY BUILDING REPORT

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

Acronym: ENVISION

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Executive Summary

The aim of the D5.8 Add-on development showcase and capacity building report is to present the results of the activities performed in order to increase the awareness of the ENVISION solution to the relevant stakeholders.

Specifically, the deliverable is divided in the following chapters:

- **Introduction,** a brief description of the aim of the deliverable.
- **Add-on development tool,** a presentation of the means that have been developed for promoting the ENVISION services and assisting third-parties for performing integration.
- **Capacity building,** a presentation of the actions that have been in order to promote the ENVISION services and platform.
- **Conclusion and Future Directions,** a brief description of the main outcomes of the actions performed.

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1 Introduction

This deliverable includes the achievements in the area of add-on development for the ENVISION services and platform and reports on the associated capacity-building activities. The objective is to showcase the added-value of such tools and detail how they could enhance the existing capabilities of the platform. Additionally, it sheds light on the capacity-building activities undertaken to ensure maximum utilisation of these tools.

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2 Add-on development tool

The ENVISION Add-On development tools have been implemented within Swagger and Kaggle platforms in order to advance agricultural data accessibility and analysis and provide intuitive and streamlined interfaces for users. The ENVISION Add-On development tool offers real-time access to an extensive collection of ENVISION datasets. These encompass parcel geometries, LPIS data, crop classification results, and a multitude of satellite-derived insights sourced from Sentinel-2 optical images and Sentinel-1 SAR data. Notably, users can delve deep into datasets highlighting mowing detection outcomes, NDVI metrics, and distinctions in organic farming practices, among others. Each dataset is enriched with comprehensive descriptions, illuminating examples, and corresponding responses. This is not only ensures easy navigation but also strengths the contextual comprehension of the multifaceted agricultural landscapes.

Building an add-on development tool in Swagger offers numerous advantages, primarily due to its inherent features and capabilities. First of all, Swagger provides an interactive interface where developers and third-parties can directly interact with the API, making it easier to understand ENVISION's functionality and potential use cases. This live interaction promotes better understanding of the available endpoints, methods, and responses. Furthermore, Swagger follows an OpenAPI Specification (OAS), a standard format for designing and documenting APIs. This ensures consistency and promotes best practices across the development process of other services or add-ons on top of the ENVISION solutions. With Swagger's interactive UI, developers can directly test the ENVISION endpoints, observe responses, and debug in real-time. This feature speeds up the development and testing process considerably. In addition, Swagger provides a visually appealing representation of the API's structure and capabilities, making it user-friendly even for non-technical stakeholders. Of course, Swagger has built-in support for API security standards, helping developers to build secure APIs by offering insights into potential security flaws and ensuring best practices are followed. Something that is aligned with the open-source platform principles.

Combining Swagger and Kaggle to build the add-on development tool leverages the strengths of both platforms resulting in a robust, comprehensive, and user-friendly tool that can cater to a wide range of development and data analysis needs. By combining Swagger with Kaggle, the end-users can directly tap into advanced analytics and machine learning models. This facilitates deeper insights as developers and data scientists can experiment with the raw data, and build predictive models. Furthermore, the collaborative environment is enhanced. While Swagger enables the API development collaboration, Kaggle provides a community-driven platform where data enthusiasts share kernels, datasets, and insights. In such a way, ENVISION broads the community that shares the outcomes, enhances the overall utility of the add-on development tool, and ensures that the tool remains up-to-date with the latest in data science trends.
Below it is presented an example of Swagger of how a user can retrieve parcels from the ENVISION dataset by point radius.

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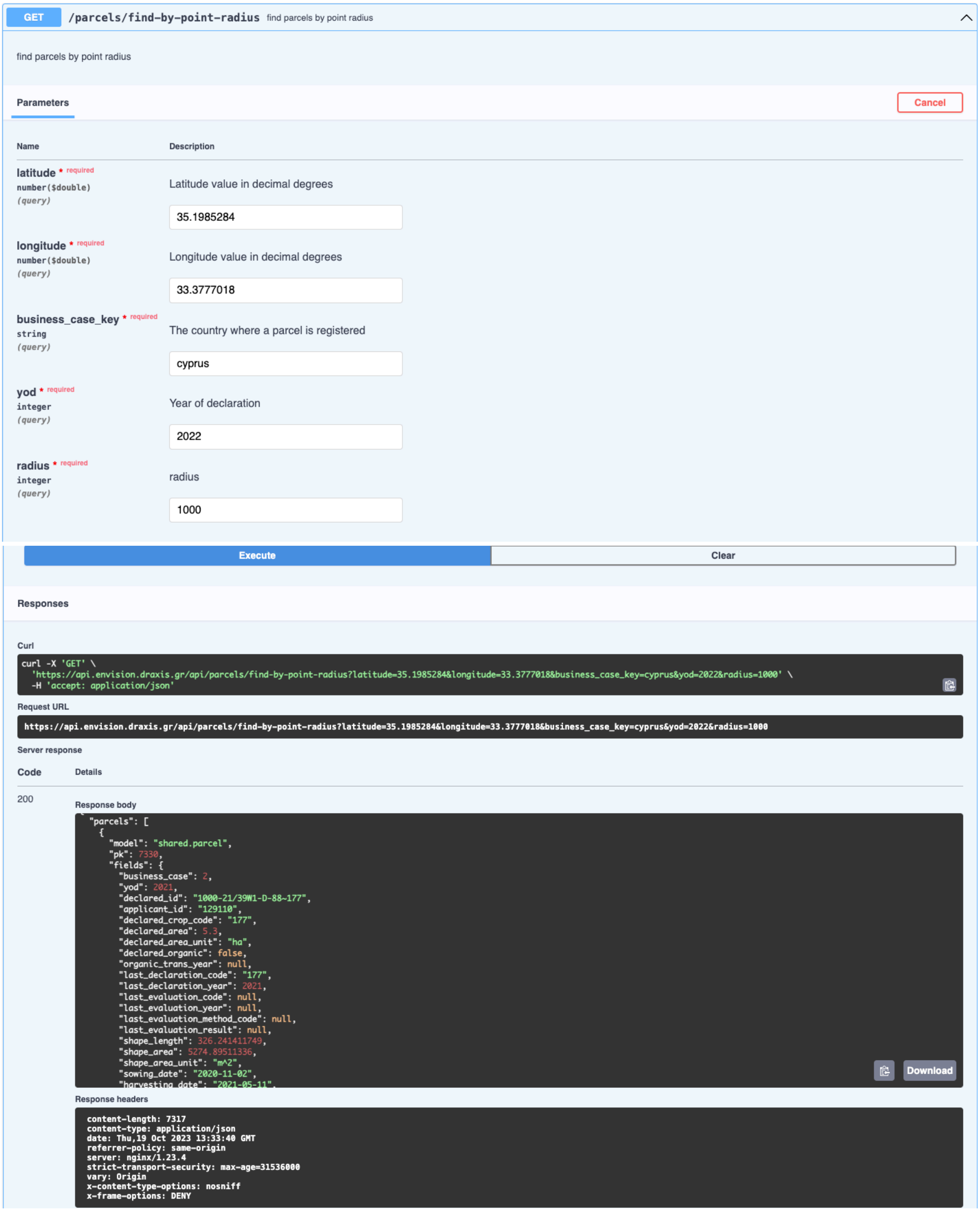

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Responses

Code	Description	Links
200	Successful operation	*No links*

Media type

application/json

Controls Accept header.

Example Value | Schema


```json
{
  "id": 25834,
  "yod": 2023,
  "declared_crop_code": "42",
  "geom": {
    "type": "Polygon",
    "coordinates": [
      [
        {
          "lat": 5698944.306614961,
          "long": 2222238.013378226
        }
      ]
    ]
  }
}
```


GET `/parcels/find-by-bounding-box` find parcels by bounding box

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3 Capacity Building

Workshop #1: Introduction to the ENVISION Add-on Development Tool

Participants: 6 (2 developers from Spotify, 1 Business Analyst from Unisystem, 1 developer from IBM, and 2 developers from Schoox)

Aim: The aim of this workshop was to introduce participants to the ENVISION add-on development tool, ensuring they gain a comprehensive understanding of its features, functionalities, and potential applications. The workshop sought to equip developers from diverse organisations with the knowledge and skills needed to effectively integrate and leverage the ENVISION tool in their respective interests.

Feedback/ Recommendations:

1. **Positive Insights:**
    - The developers found the tool’s user interface intuitive and user-friendly, especially for those familiar with platforms like Swagger and Kaggle.
    - The tool's integration capabilities with different datasets and APIs were well-received, highlighting its versatility.
2. **Areas for Improvement:**
    - A more detailed documentation was recommended, especially focused on potential enterprise integrations.
    - An emphasis was placed on the tool’s potential in cloud environments and suggested further optimisations for such deployments.
    - The tool’s educational potential was highly appreciated and recommended the development of learning modules tailored for training platforms.
3. **General Recommendations:**
    - A consensus was reached on the need for more frequent updates, ensuring the tool remains in sync with evolving tech trends.
    - A deeper dive into security protocols was recommended, given the sensitive nature of data that may be processed.

Conclusion: The workshop successfully familiarised participants with the ENVISION Add-on development tool, gathering valuable feedback from developers representing a diverse array of companies. The insights provided will play a pivotal role in the exploitation and enhancement the tool, ensuring it remains relevant, robust, and in line with the demands of modern development environments. Moving forward, the ENVISION team is poised to integrate the feedback, continuously iterating on the tool to drive adoption and deliver tangible value to its users.

Workshop #2: Presentation of the ENVISION Add-on Development Tool in the Agricultural Sector

Participants: 2 (Assistant Professor and Agronomist from the Laboratory of Agricultural Engineering, Faculty of Agriculture of Aristotle University)

Aim: The aim of the workshop was to present the ENVISION Add-on Development tool specifically within the context of the agricultural sector. The intention was to demonstrate how the tool can be employed to advance agricultural research, analytics, and practices. Furthermore, the workshop sought to gather insights from experts in the agricultural field to better tailor the tool’s offerings to meet the challenges and needs of the industry.

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Feedback/ Recommendations:

1. **Positive Insights:**
    - The tool's capability to process and analyse various agricultural datasets, such as parcel geometries, LPIS data, and crop classification results, was commended. The participants appreciated the detailed nature of the insights and the potential impact on agricultural practices.
    - The Assistant Professor highlighted the academic value of the tool, emphasizing its potential in fostering student research, especially in areas like remote sensing and precision agriculture.
2. **Areas for Improvement:**
    - The Agronomist pointed out the importance of ground-truthing in agricultural research and recommended integrating a feature that allows users to validate satellite-derived data with on-field observations.
    - Both participants emphasized the potential utility of mobile version of the tool for on-field data collection and analysis.
3. **General Recommendations:**
    - It was suggested that future iterations of the tool should incorporate more region-specific datasets, considering the varying agricultural practices and challenges across different geographic areas.
    - Collaboration with local agricultural bodies and institutions for data sourcing and validation was recommended.

Conclusion: The workshop served as an invaluable mean to introduce the ENVISION Add-on Development tool to experts in the agricultural sector, specifically from an academic and practical perspective. The feedback provided will be essential in refining the tool's features to cater more specifically to agricultural professionals and researchers. Given the tool's potential impact in modernising and enhancing agricultural practices, the ENVISION team is dedicated to incorporating the insights received to ensure the tool remains relevant and impactful in the sector.

Workshop #3: ENVISION Add-on Development Tool and its role in the open-source community
Participants: 1 (Tech Relations Lead in eyeo, member of the open-source community)
Aim: The aim of the workshop was to present the ENVISION Add-on Development tool in the context of the open-source community. The goal was to showcase how the tool aligns with the principles of open-source development, its potential contribution to the community, and how it can foster collaborative innovation. Engaging with an esteemed member of open-source community was aimed at obtaining deeper insights into ensuring the tool is well-positioned to drive open innovation and shared development.
Feedback/ Recommendations:

1. **Positive Insights:**
    - The participant commended the initiative of the ENVISION team to contribute to the open-source community in correlation with the agricultural data.
    - The comprehensiveness of the datasets and the interoperability of the tool were recognised as strengths, offering developers a rich mean to build upon.
2. **Areas for Improvement:**

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- While appreciating the tool's capabilities, there was a recommendation to provide comprehensive documentation, and developer guides. This ensures that developers to the agricultural domain, can utilise the tool efficiently.
- The need for a more robust feedback mechanism was highlighted, allowing the open-source community to regularly provide inputs, report bugs, and suggest enhancements.

3. **General Recommendations:**
   - To truly embed the tool withing the open-source community, it was suggested to host periodic webinars or developer meetups. These events can act as means for knowledge exchange, collaborative problem-solving, and community building.
   - Collaborating with existing open-source projects or platforms in the agricultural sector can provide synergies and drive collective growth.

Conclusion: The workshop was important in aligning the ENVISION Add-on Development Tool with the needs and requirements of the open-source community. The feedback provided will guide the tool's exploitation and evolution, ensuring it not only serves as a valuable open-source asset but also actively fosters a community around it.

Hackathon – NASA International SPACE APPS Challenge Thessaloniki Hackathon in collaboration with ENVISION and CALLISTO

Figure 1: Organisers and sponsors of the Hackathon

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Figure 2: Kick off of the hackathon - Presentation of the ENVISION solutions

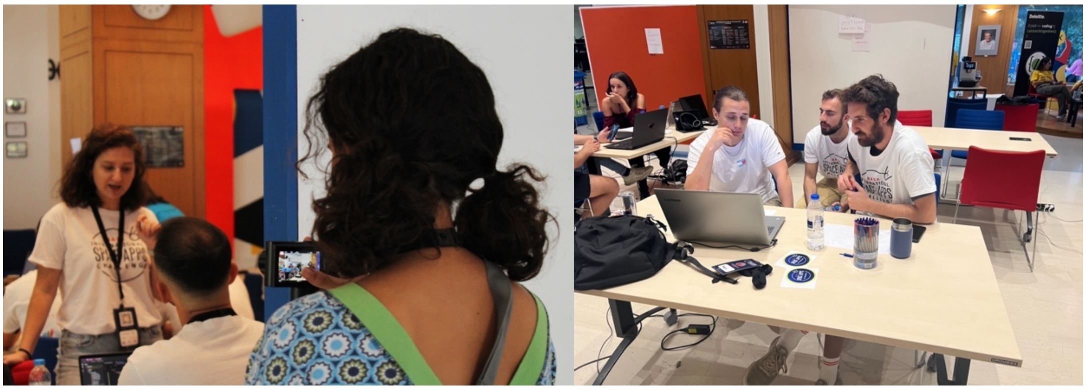
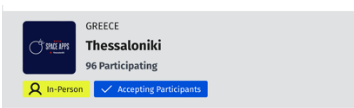


Figure 3: Coaching and mentoring on the provided datasets

The aim of the hackathon was to leverage the collaborative power of experts, developers, and enthusiasts from around Europe to innovate and develop groundbreaking solutions using free and open data from NASA and its Space Agency Partners. This event was particularly crucial for the ENVISION project, as it provided an avenue to test, validate, and further enhance the project's datasets and tools in real-world scenarios. Collaborating with prestigious institutions like NASA elevated the event's significance, bringing global attention to the project's objectives and resources.
The hackathon attracted 96 participants.



The challenge posed by the ENVISION and CALLISTO projects was "Services 4 CAP monitoring". This challenge provided plethora of data derived from ENVISION and CALLISTO projects. Participants

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harnessed the power of in-situ data, EO-based products, satellite, and street-level-imagery facilitating them to develop and/ or level-up services for monitoring CAP standards and agro-environmental practices. The challenge combined the fusion of data from multiple sources in order to extract crop type map for a sample area of Cyprus as well as to visualize the results on a web application. A team has selected our challenge and used our open-source platform code and the provided data to rebuild the ENVISION platform.

The hackathon kickstarted with a brief introduction to the challenges, with special emphasis on "Services 4 CAP monitoring". Participants were then given access to the extensive data repository from the ENVISION and CALLISTO projects through the Add-on Development tool. This encompassed in-situ data, EO-based products, satellite, and street-level-imagery. The day progressed with brainstorming sessions, team formations, and initial ideation. The ENVISION team was available for consultations, providing insights into the data's differences and potential applications.

Teams dived deep into data analysis, fusion, and application development. The challenge centered around fusing data from diverse sources to extract a crop type map for a sample area in Cyprus and subsequently visualizing the results on a web application. Participants energetically tapped into the open-source code of the ENVISION platform, repurposing and enhancing it for the challenge's requirements. The day concluded with presentations, evaluations, and a spirited discussion on the Kaggle challenge.

The hackathon was resounding success, not just in terms of participation but also the quality of solutions presented. The team that undertook the "Services 4 CAP monitoring" challenge notably showcased the potential of the ENVISION platform by rebuilding and enhancing it, demonstrating its robustness and adaptability.

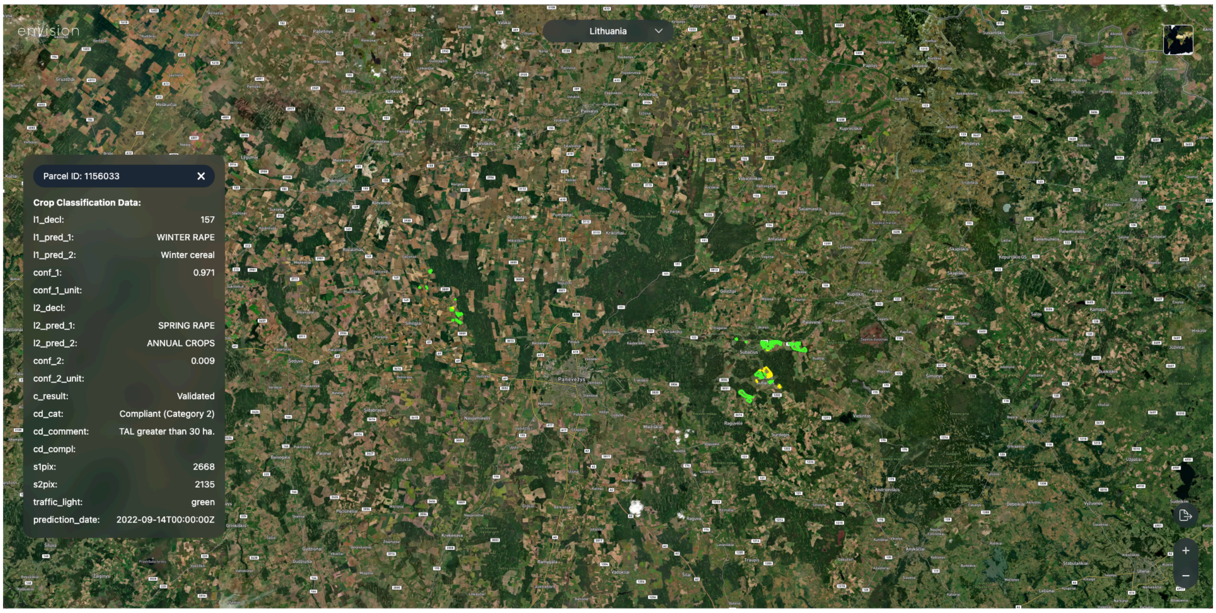

Figure 4: ENVISION-hackathon [platform](#) stored in [Zenodo](#) under the ENVISION Community

The main lessons learned derived from the hackathon experience are:

1. The open-source nature of the ENVISION platform was a key enabler for innovation, allowing participants to seamlessly access, modify, and repurpose the code.

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2. Data comprehensiveness and quality are important. The diverse datasets from the projects provided participants with a rich foundation to build upon.
3. Real-world events like hackathons provide valuable feedback, uncovering potential areas of improvements that may not be evident in controlled project environments.

Post-hackathon, the ENVISION project benefitted immensely from the fresh perspectives and innovative solutions presented from developers. The event acted as a robust validation exercise, reinforcing the project's direction and objectives. The global visibility and recognition gained from the event further enhanced ENVISION’s position in the open-source developers’ community.

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4 Conclusion and Future Directions

Ensuring seamless integration and collaboration, our implementation adheres to industry standards and promotes interoperability. The use of Swagger and Kaggle provides a unified interface for developers and researchers, fostering a standardized approach to accessing agricultural data. This not only enhances usability but also encourages a cohesive ecosystem for sharing and utilizing agricultural information.

Furthermore, recognizing the importance of community collaboration, our tools are open-source, inviting developers and researchers to contribute, enhance, and customize the functionalities. The transparency of our codebase encourages innovation, peer review, and the collective improvement of tools vital for the agricultural research community. As the API grows and evolves, maintaining the documentation and ensuring its accuracy can be challenging. ENVISION's add-on development tool supports automated documentation updates ensuring that as endpoints are added or modified, the documentation remains accurate, up-to-date and ready for further exploitation.

The insights gathered from the capacity building activities will shape future pathways for similar projects that will provide open-source solutions to the agro-environmental sector:

- **Importance of Open-Source Flexibility:** The capacity building activities underscored tremendous potential that open-source platforms hold. Future projects should prioritize an open-source approach, ensuring easy access and adaptability of tools and datasets to cater to a broader spectrum of users and applications.
- **Emphasis on Comprehensive Data:** The foundation of any agro-environmental solution lies in the quality and comprehensiveness of its data. Future endeavors must invest in collecting, curating, and constantly updating diverse datasets. These datasets should be easily integrable and customizable, allowing users to extract maximum value.
- **Collaborative Events as Feedback Mechanisms:** Regularly hosting or participating in events like hackathons provides an immediate and practical feedback loop. It exposes the platform to real-world scenarios, helping identify both strengths and areas of improvement.
- **Building a Strong Community:** For an open-source platform to thrive, a strong and engaged user community is essential. This not only aids in refining the platform through diverse inputs but also assists its adoption and adaptability across various sectors.
- **Fostering Cross-sector Partnerships:** The collaboration between ENVISION, CALLISTO, and NASA underlined the value of forging partnerships across sectors. Such alliances can drive innovation by combining diverse expertise and resources.
- **Continual Learning and Iteration:** Open-source platforms in the agro-environmental sector should be seen as living entities, constantly evolving based on user feedback, technological advancements, and changing environmental dynamics. An iterative development approach ensures the platform remains relevant and cutting-edge.

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