

Digital Decision Support Tools for accelerated transition to agroecology by smallholder farmers

Presented by: Domen Mongus | UM
(PrAECTiCe) Agroecology Summit
17th October 2024



Funded by
the European Union

PrAECTiCe project is funded by the HORIZON Europe programme under Grant Agreement number 101084248



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Agenda

OBJECTIVE: Developing a decision support tool for identifying best agroecological practices

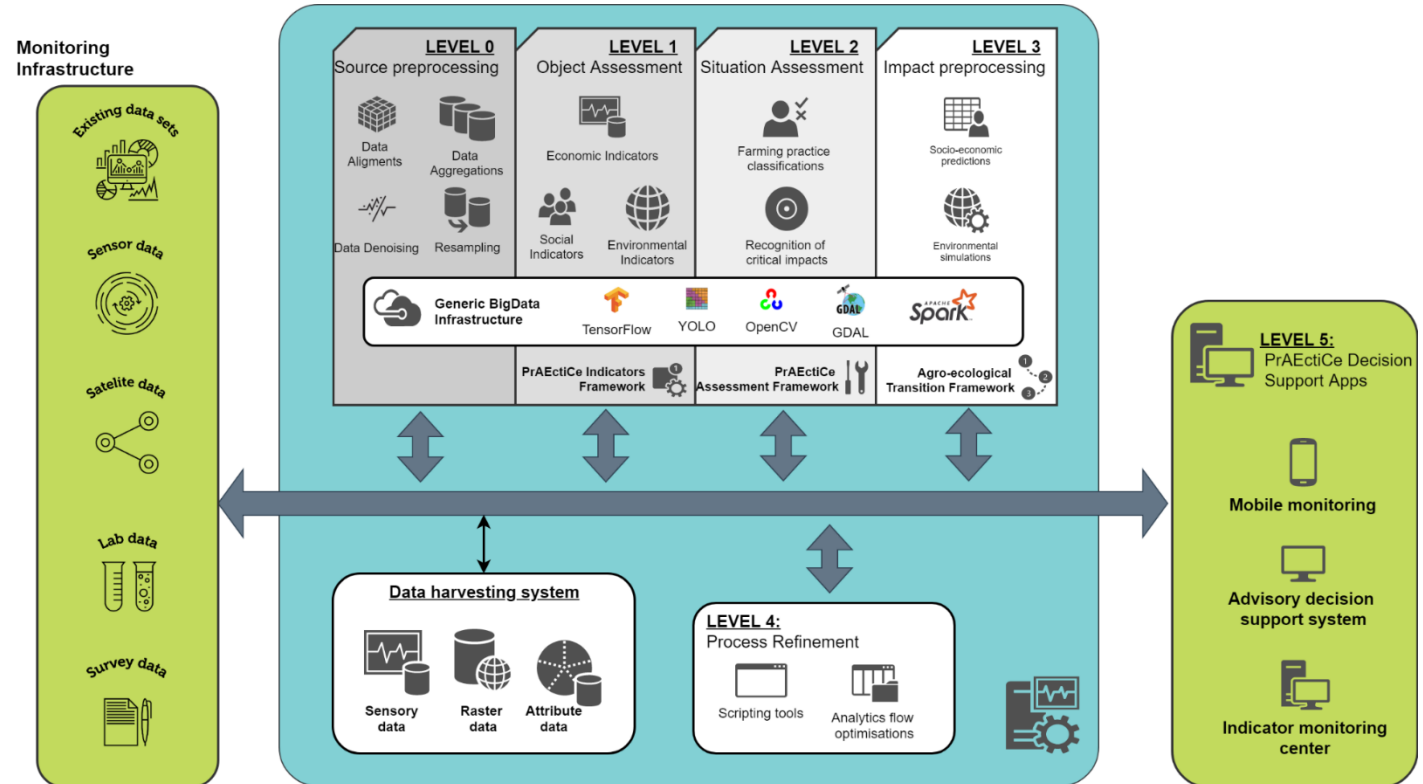
- Overall system architecture
- Key functional requirements
- Progress up to now
- Open questions and next steps



System architecture



- Gather as much data as possible
- Extract relevant information in a form of indicators
- Deliver the right information to the right end-user
- Enable appropriate exploitation of data for making the real-world impacts



Key components

Data connectors and harvesting system

- Implements workspace
- Gathers all the data
- Data storage for processing
- Distribution of data products i.e. indicators

Indicator monitoring center

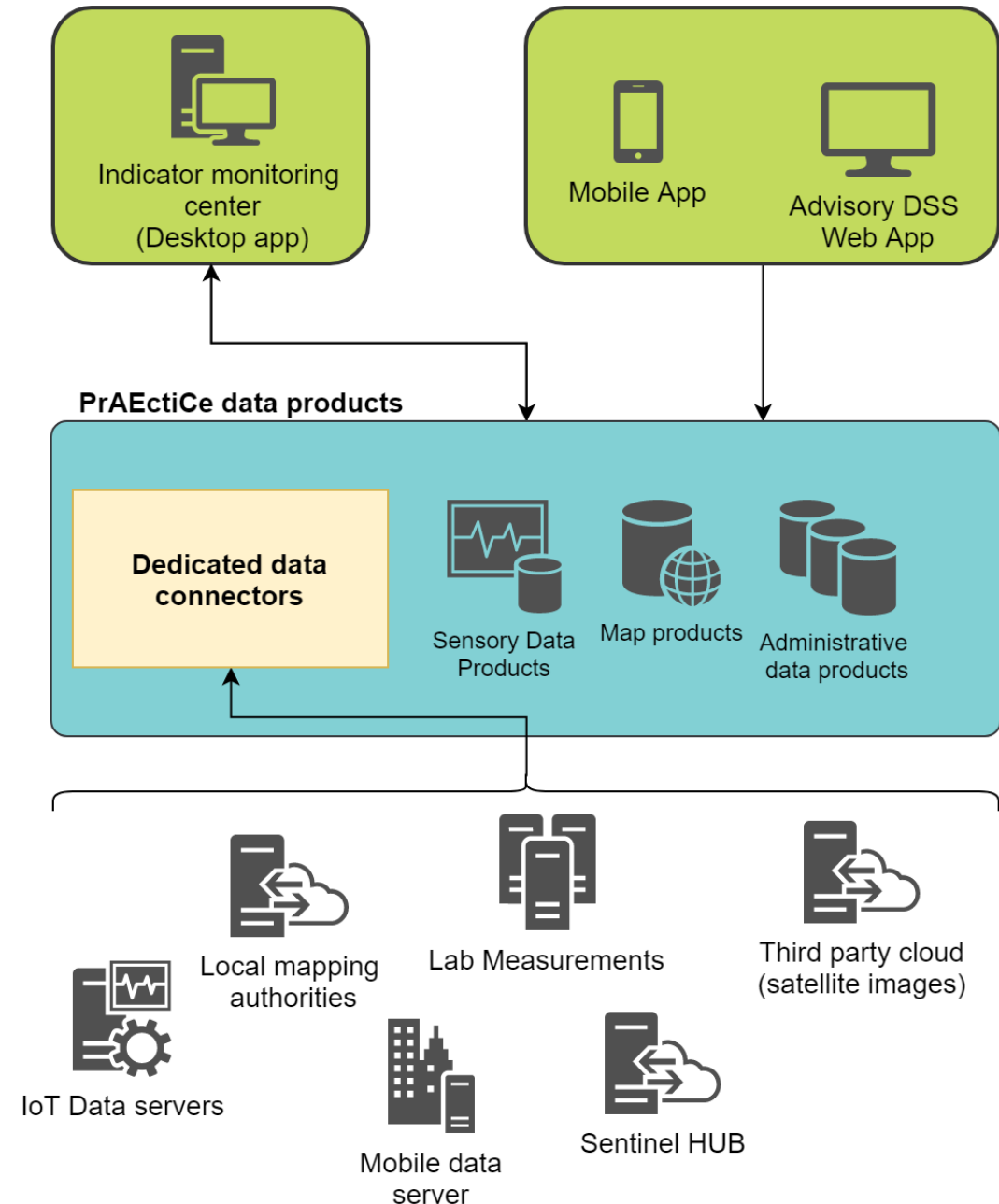
- Prepares the data for usage
- Provides data analytics capacities
- Implements AI for generating new data products
- Ensures QA over the produced indicators

Mobile (farmer) app

- Displays indicator to a farmer
- Provides management functionalities
- Provides communication with advisor

Advisory DSS

- Management of multiple farms
- Enable analytics over indicators
- Provides content editing



Monitoring center

Data management tools

Data sources

Data products

Object properties



The screenshot shows the PrAectiCe software interface. The main window displays an aerial satellite image of a rural area with several buildings and fields. A pink polygon highlights a specific field. The interface includes a top menu bar with options like File, Digitalization, Data, Dtm/Lidar, Validation, Tools, Database, Server, Windows, Processing, Farms, and Geometry [1], Fields. Below the menu is a toolbar with various icons for editing and data management. On the left, there are two panels: 'Data sources' and 'Project items [PrAectiCe Applications]'. The 'Data sources' panel lists various data providers like User files, XYZ Tiles, OGC WMS, etc. The 'Project items' panel shows a tree view of project components such as Shapes, Rasters, Lidar, and Maps. On the right, a 'Fields' panel is open, showing a table of field properties for a selected field.

Property	Value
Feature Identifier	40
Feature type	Field
Feature name	Replication 2
Feature description	
Database properties	
Date created	2024-09-24T11:53:41.127...
Date updated	2024-09-24T12:17:28.479...
Monitoring properties	
Valid from	2023-01-01T00:00:00.000000...
Valid until	2028-01-01T00:00:00.000000...
Is enabled	true
Field properties	
Crop type	Mixed - Swiss chard and ...
Treatment type	Fish pond water
Geometry Properties	
Base Geometry Type	Polygon
Determined Geometr...	Polygon
Is Multipart	No
Has Z	No
Has M	No
Is modified	No
Num. Points	5
Num. Parts	1
Area	279.121094
Length/Perimeter	66.887521
Circularity	0.000000
Error Count	0

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Monitoring center

Satellite data

Indicators
Data products

The screenshot shows the PrAectiCe software interface. The main window displays a satellite image with a green polygon overlaid on it. The interface includes a menu bar at the top with options like File, Digitalization, Data, Dtm/Lidar, Validation, Tools, Database, Server, Windows, Processing, Farms, and Geometry (Farms). Below the menu is a toolbar with various icons for editing and analysis. On the left side, there is a 'Data sources' panel with a tree view showing various data layers such as LANDSLIDE, MSAW2, MSI, MSK_CLDPRB, MSK_SNNWPRB, NBRI, NDBSI, NDGI, NDMI1, NDMI2, NDSI, NDVI, NDWI, NPCRI, and OSAVI. Below this is a 'Project items' section with a tree view showing 'Shapes' and 'Farms' layers. On the right side, there is a 'Properties' panel with 'Attribute Properties' and 'Geometry Properties' sections. The 'Attribute Properties' section shows fields like Fid, Type, Name, Description, DateCreated, DateUpdated, and Owner. The 'Geometry Properties' section shows fields like Base Geometry Type, Determined Geom..., Is Multipart, Has Z, Has M, Is modified, Num. Points, Num. Parts, Area, Length/Perimeter, Circularity, and Error Count. At the bottom of the window, there is a status bar showing the coordinate system (EPSG:3857 / WGS 84 / Pseudo-Mercator) and various coordinates.

Object properties



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Monitoring center

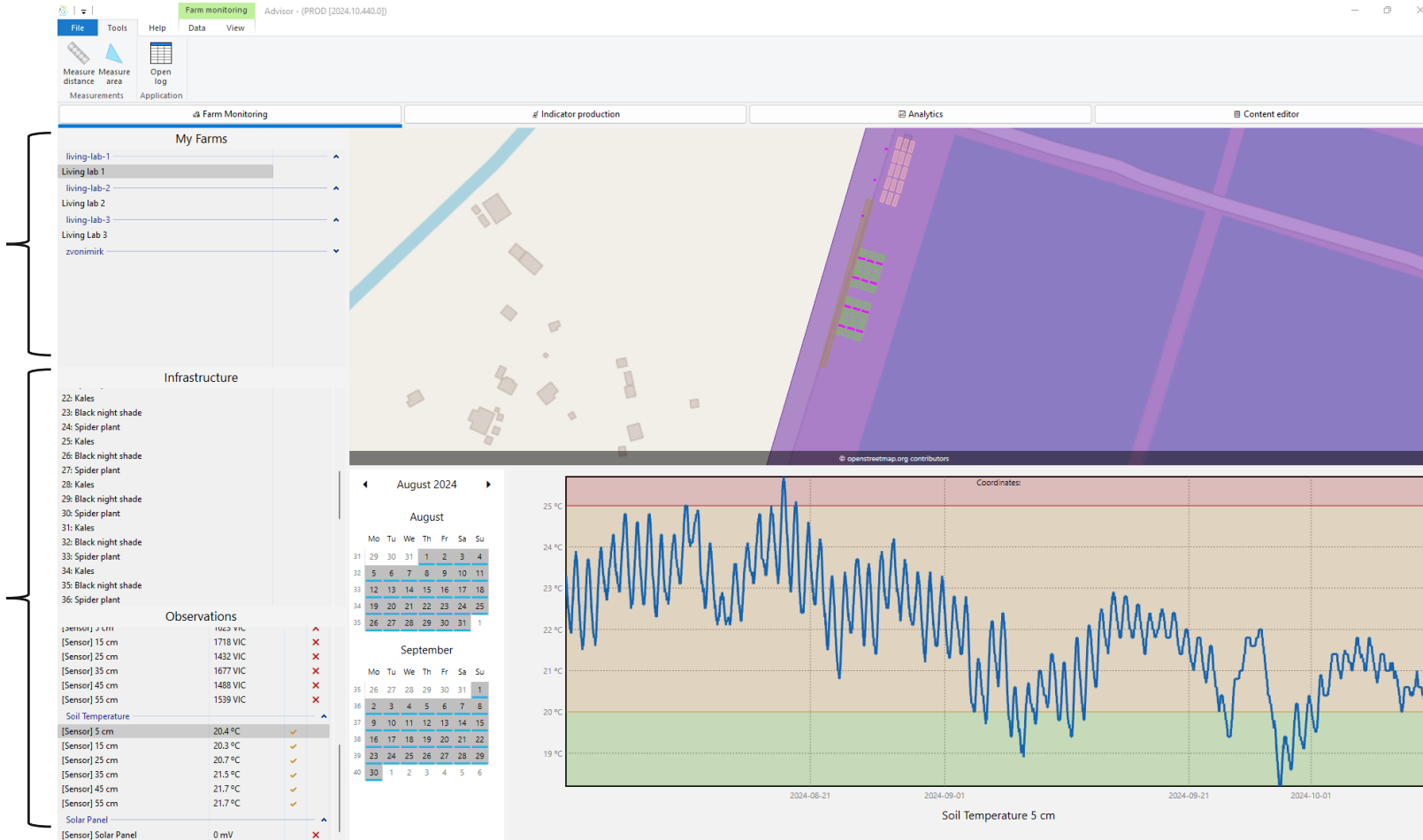
Sensory data management tools



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Location info

Sensor info



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Monitoring center

Sensory data management tools



Location info

Sensor info

The screenshot displays the GeMMA Fusion Suite - PrAectiCe Applications interface. The main window shows a map with a green background and a white polygon overlay. The interface includes a top toolbar with various tools, a left sidebar with a tree view of data sources and project items, and a right sidebar with attribute and geometry properties for the selected shape.

Data sources:

- LANDSLIDE
- MSAVI2
- MSI
- MSK_CLDPRB
- MSK_SNWPRB
- NBRI
- NDBSI
- NDGI
- NDMI1
- NDMI2
- NDSI
- NDVI
- NDWI
- NPCRI
- OSAVI

Project items [PrAectiCe Applications]:

- Shapes
 - Farms
 - Infrastructure
 - Ponds
 - Fields
 - Countries
 - Samples
 - Living Lab 1 MBR (IOT_DEVICES)
 - Living Lab 1 Field Monitoring (IOT_DEVICES)
 - Living Lab 1 Weather History (IOT_DEVICES)
 - MyIrrigation (IOT_DEVICES)
 - Living Lab 3 Weather History (IOT_DEVICES)
 - Living Lab 3 field monitoring (IOT_DEVICES)
- Rasters
 - Offline maps
 - Sentinel
 - NetCDF
 - Lidar
 - Point clouds
- Databases
- Maps
 - Google maps satellite
 - Google maps
 - NDWI
- Geometry topology and attribute rules
- Table data
- Features

Attribute Properties:

Fid	2
Type	Farm
Name	Living lab 2
Description	Living lab 2 farm
DateCreated	2024-07-08T07:38:39.824...
DateUpdated	2024-07-08T08:42:41.323...
Owner	living-lab-2

Geometry Properties:

Base Geometry Type	Polygon
Determined Geomet...	Polygon
Is Multipart	No
Has Z	No
Has M	No
Is modified	No
Num. Points	5
Num. Parts	1
Area	174648.586380
Length/Perimeter	1732.039706
Circularity	0.000000
Error Count	0

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Content editor

Soil temperature for Spider Plant

Monitoring area



The screenshot displays the PrAectiCe content editor interface. On the left, a table lists indicators under 'Farm Monitoring'. The main panel shows the details for the 'Spider plant' indicator, including its key, type, tags, abstract, and content. Below the text are two photographs of the plant. A 'Properties' table is also visible. On the right, a map of Kenya shows the monitoring area. Below the map is a table of soil temperature ranges and solutions.

Category	Low	High	Solution
Good	14.000000	20.000000	No action needed
Adequate	10.000000	14.000000	Cold soil, build warm bed
Poor	-inf	10.000000	Soil too cold for growth, build warm bed and ...
Adequate	20.000000	25.000000	Soil is getting too warm
Poor	25.000000	inf	Soil is too hot for growth

Categories and alerts

General info provided by advisor



WP4 – Next steps

As follows from Task 1.3 – Co-creation activities with key stakeholders

Onboarding:

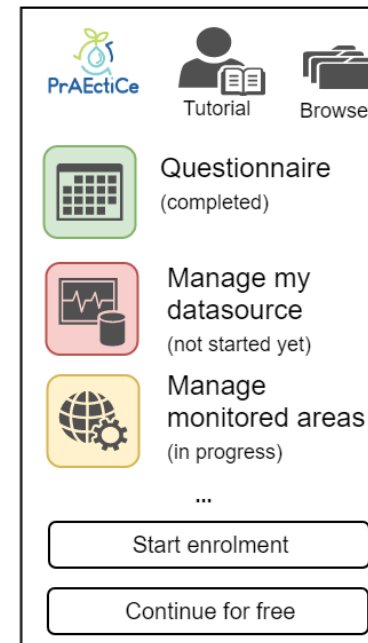
Screen #1 - Login



Screen #1.1 - New user



Screen #1.2 - Enrolment



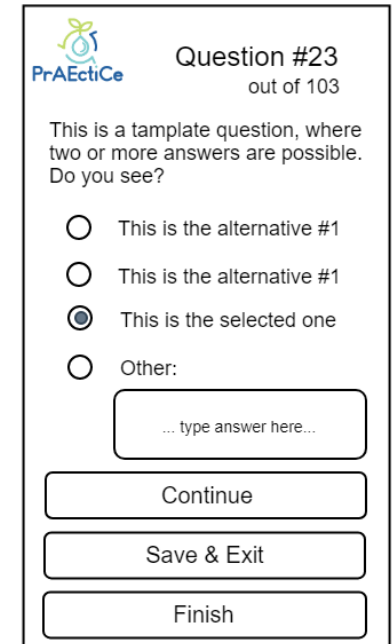
Enrolment tutorial and data source browser

Current level of AE transition

Fishpond, agricultural, field, ...

Only private ones?

Screen #1.2.1 - Questionnaire



Select the initial screen

OPTIONAL:

- selection of programs, additional to AE transition

WP4 – Next steps

Example - Questionnaire

1. Awareness and Understanding of Water Quality in Fish Farming

- Are you aware of the significance of water quality in fish farming?
- On a scale from 1-10, how would you rate your understanding of the water quality parameters essential for fish health and growth?
- Which water quality parameters do you believe are the most crucial in fish farming?

4. Use of Electronic Sensors

- Are you currently using any electronic sensors to monitor water quality? If yes, please specify the parameters these sensors measure.
- How often do these sensors take measurements (e.g., continuously, hourly, daily)?
- Are you alerted in real-time if any parameter goes out of the desired range?

2. General Farming Practices and Infrastructure

- What type of water bodies are you using for your fish farming (e.g., ponds, tanks, cages)?
- Are your water sources natural (like rivers or lakes) or artificial (like bore wells or tap water)?
- How often do you change or refresh the water in your system?

5. Management Based on Water Quality Data

- How do you use the water quality data in managing your fish farm?
- Have you ever had to take immediate action based on the water quality data received?
- Do you believe that continuous monitoring of water quality can lead to better fish health and increased yield?

3. Current Water Quality Monitoring Practices

- Do you currently monitor water quality in your fish farming system?
- Which water quality parameters do you routinely measure?
- How do you currently measure these parameters (e.g., manual test kits, electronic sensors)?

6. Future Investments in Monitoring

- Are you considering investing in more advanced water quality sensors in the future?
- What obstacles or concerns do you have regarding implementing continuous water quality monitoring?

WP4 – Next steps

As follows from Task 1.3 – Co-creation activities with key stakeholders

Onboarding:

Screen #1.2 - Enrolment

PrAectiCe Tutorial Browse

Questionnaire
(completed)

Manage my datasource
(not started yet)

Manage monitored areas
(in progress)

...

Start enrolment

Continue for free

Screen #1.2.3 - Register data source

PrAectiCe Tutorial Browse

My data sources

Satellite NDVI
Private oxygen IoT Sensor
National weather monitoring
Manually gathered soil quality

...

Add new

Save & Exit

Finish

Screen #1.2.3.1 - New data source

PrAectiCe Tutorial Browse

My new data source:

Maps Lab tests

Senzor Open data

Citizen Science My costs and supplies

Exit

WMS and WFS service

From known provider, such as my irrigation

Manual data inputs (e.g. water phd by paper)

Results from lab tests

UN, World Bank, National Stats,...

What did I buy, what did I spent, ---???

Screen #1.2.3.2 - New sensor

PrAectiCe Tutorial Browse

My new sensor:

Name:

Select provider:

Type:

Unit:

Frequency:

...

Save

Exit

Continue for free -> no advisor informed advisor

WP4 – Next steps

Example - Questionnaire for monitoring

1. Clarity of the water

- Crystal clear: Ideal water quality. Minimal suspended particles.
- Slightly turbid: Some suspended particles present. Could be due to slight imbalances, feeding residues, or minor disturbances.
- Moderately turbid: Increased particles or possible microbial activity. Could indicate potential water quality issues.
- Highly turbid or opaque: Serious water quality concern. Immediate attention required.

4. Ammonia, nitrite, or nitrate levels (Chemical Test Kits)

- All within desired range: Healthy water conditions.
- Ammonia elevated: Toxic to fish. Indicates issues with nitrogen cycle or overfeeding.
- Nitrite elevated: Harmful to fish. Shows problems in nitrogen conversion.
- Nitrate elevated: Less toxic but in high amounts can stress fish.
- Multiple parameters elevated: Serious imbalance. Immediate intervention required

2. Unusual color changes

- Normal color: Indicative of healthy water conditions.
- Greenish tint: Possible algal bloom, which can deplete oxygen and release toxins.
- Brownish or muddy: High sediment or detritus. Could affect fish respiration and health.
- Other unusual colors: Could be from various sources like pollutants. Needs identification and action.

5. Secchi Disk (Chemical Test Kits)

- < 0.5 meters: High turbidity. Might indicate algal blooms or sediment issues.
- 0.5 to 1 meter: Moderate turbidity. Monitor other water quality parameters.
- 1 to 1.5 meters: Good clarity. Healthy water.
- > 1.5 meters: Excellent clarity.

3. pH level (Chemical Test Kits)

- < 6.5 (acidic): Can stress fish, leading to diseases. Needs buffer to raise pH.
- 6.5 to 7.5 (neutral): Ideal for most fish species.
- > 7.5 (alkaline): Can be harmful if too high. Might require pH adjustment.

6. ...

- ...

WP4 – Next steps

Example - Questionnaire for monitoring

6. Pollutant-sensitive species (Bio-indicators)

- Abundant and thriving: Indicates excellent water quality.
- Present but fewer: Some environmental stressors may be present.
- Rarely observed: Concerning drop in water quality.
- Not observed at all: Serious water quality concerns.

7. Pollutant-tolerant species (Bio-indicators)

- Not observed: Excellent water quality.
- Few in number: Good water conditions, but continuous monitoring needed.
- Moderately present: Indicative of declining water quality.
- Abundant: Poor water quality.

8. Fish Behavior Observations

- **Surface Gassing:** Fish frequently coming up to the water surface appearing to "gasp" for air.
- **Erratic Swimming:** Fish swimming in an erratic or spasmodic manner
- **Huddling:** Fish clustering together in one area, often in a corner or near the aerator.
- **Reduced Appetite:** Fish not actively seeking food or ignoring feed altogether.
- **Rubbing Against Surfaces:** Fish frequently rubbing or "flashing" against rocks, plants, or other surfaces in the tank or pond.
- **Floating or Sinking:** Fish remaining at the water surface or bottom without much movement.

WP4 – Next steps

As follows from Task 1.3 – Co-creation activities with key stakeholders

Monitoring:



Screen #2 - Home



Real time monitoring

Historical data analysis

Scheduling activities and inputing data

Managing profile, registering data sources ...

Parameters for the whole farm

Screen #2.1 - My farm



Zoom

Display graph

Select parameter

Screen #2.1.1
Parameter selection



Screen #2.1.2
Alert selection



Zoom



WP4 – Next steps

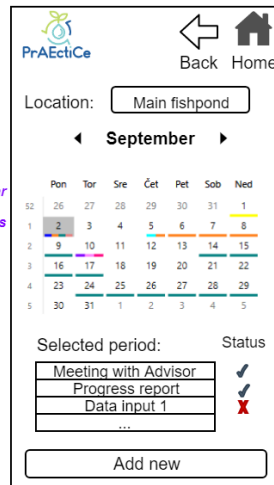
As follows from Task 1.3 – Co-creation activities with key stakeholders

Monitoring:

Screen #2 - Home



Screen #3.1 - Activities



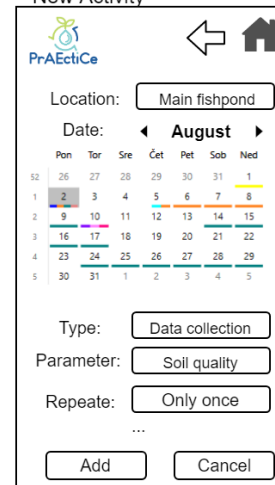
Calendar with activities

List of activities for the selected date

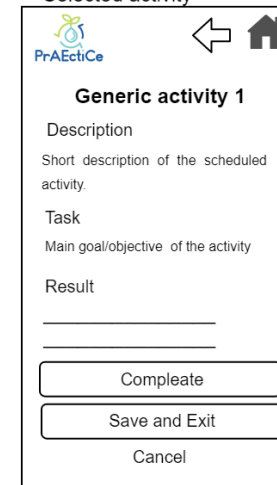
Change shown activity

Possible advisory events

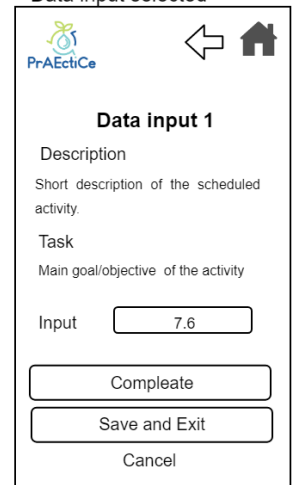
Screen #3.2 - New Activity



Screen #3.3 - Selected activity



Screen #3.4 - Data input selected



WP4 – Next steps

As follows from Task 1.3 – Co-creation activities with key stakeholders

Monitoring:

Screen #2 - Home

The home screen features a top navigation bar with a home icon, the PrAectiCe logo, and a refresh icon. Below this are four main function icons: Monitoring (globe with gear), Scheduler (calendar), Analytics (line graph with bar), and Settings (gear). At the bottom, there is an 'AE Transition Progress' bar with a leaf icon and a 'Log out' button.

Screen #3.1 - Analytics

The analytics screen displays a satellite view of a farm with labels for 'VicInAqua' and 'Victoria Pure Group'. Below the map is a table titled 'My locations:' with a 'Status' column.

My locations:	Status
Farming center	
Main fishpond	
Corn field	
Small fishpond	
....	

Screen #3.2 - View region

The 'View region' screen shows a map with a location marker for 'VicInAqua'. Below the map are 'Analytics tools' including 'Inspect parameters' (magnifying glass icon) and 'Make predictions' (document with arrows icon). There is also a 'Generate reports' button (document icon).

Screen #3.2.1 - ???

This screen displays data under the heading 'Sensors data 2'. It features a donut chart for 'INSTALLS BY SOURCE' and a horizontal bar chart for 'INSTALLS BY COUNTRY'. A 'List view' button is in the top right.

INSTALLS BY SOURCE

Source	Percentage	Count
NON-ORGANIC	22%	824,861
ORGANIC	78%	824,861

INSTALLS BY COUNTRY

Country	Count
Saudi Arabia	High
Egypt	Medium
United Arab Emirates	Low
Kuwait	Low
Iraq	Low

Suggested content for farm app.

How else can advisor help me?

1. Good practices in production (digital handbook)

- General Information about products (fish types, growth conditions, complementary products for circular economy ...)
- Shiny examples of production
- Tutorials for solving critical situations
- FAQ
- Agroecological transition plans ...

2. Performance analysis

- Analyze farmers' portfolios (what farmers are producing?)
- Compare me to the others
- Analyze production capacities (what's the production of a region?)

3. Alarms and notifications

- Manually trigger an alarm (outbreaks of the diseases or pest attack) with link to the tutorial
- Automatic triggering of an alarm when monitoring indices go out of range for particular product (e.g. drop of oxygen)

4. Price lists

- Production prices
- Selling prices

5. Market access

- Lists of producers
- Lists of buyers
- Forwarding offers for purchase, sale or investment

Open issues and next steps

Challenges to be addressed

- Is the suggested content relevant?
- User-friendly design of the app
- How to address those farmers without smart phones? Is this indeed relevant?
- ...



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