demeter

TITLE: Pilot 1.4 IoT Corn Management & Decision Support Platform

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Pilot 1.4 IoT Corn Management and Decision Support Platform

1 Introduction

DEMETER aims to lead the Digital Transformation of the European agrifood sector based on the rapid adoption of advanced technologies, such as Internet of Things, Artificial Intelligence, Big Data, Decision Support (DSS), Benchmarking, Earth Observation, etc., to increase performance in multiple aspects of farming operations, as well as to assure the viability and sustainability of the sector in the long term. It aims to put these digital technologies at the service of farmers using a human-in-the-loop approach that constantly focuses on mixing human knowledge and expertise with digital information. DEMETER focuses on interoperability as the main digital enabler, extending the coverage of interoperability across data, platforms, services, applications, and online intelligence, as well as human knowledge, and the implementation of interoperability by connecting farmers and advisors with providers of ICT solutions and machinery.

DEMETER focuses on the deployment of farmer-centric, interoperable smart farming-IoT (Internet of Things) based platforms, to support the digital transformation of Europe's agri-food sector through the rapid adoption of advanced IoT technologies, data science and smart farming, ensuring its long-term viability and sustainability.

Twenty real-world pilot projects, grouped into five pilot clusters, are running within DEMETER to demonstrate and evaluate how agricultural innovations and extended capabilities benefit farmers, technology providers, and society. The topics, scope and size of the pilots are diverse, from saving resources, such as water and energy, to a more environmentally compatible crop management with reduced application of fertilisers and pesticides, to improved animal welfare and the tracing of complete supply chains.

This white paper describes the pilot 1.4 IoT Corn Management & Decision Support Platform, which aims to support the farmers in taking their decisions to manage the crops and adoption rapid decisions on distributing inputs accordingly with the state of vegetation and the agrometeorological parameters, using modern monitoring methods (satellite data, insitu sensors, forecasting tools).

Out of the diverse pilots in the project, the pilot 1.4 has been developed with various Romanian stakeholders and, especially, the maize growers, with the aim to increase this crop’ s efficiency and sustainability.

Maize is cultivated in the main cereal and oilseed-growing plains of the country, predominately by large and medium-sized farms that often use irrigation systems. For small farms, it represents a cash crop, although the technology employed is modest, in most cases relying on saved seed and lacking means to control pests. Overall, maize is a crop of high economic importance, and, for performant operations, it brings consistent value and profit margins. Therefore, it typically covers 2.2 - 2.4 million hectares yearly, placing Romania on the first place in the EU. Despite being the largest soybean producer in the EU, Romania’s average yields remain lower than those of other major maize producers, albeit they have increased steadily for the past decade. Yields also remain among the most volatile in the EU, reflecting their dependence on weather patterns. In this context, stabilizing yields and making output more predictable through technology was assessed as a priority during focus group discussions.

For our project to have meaningful impact and deliver valuable information for the industry as a whole, the selection of farmers has been carried out in different pedoclimatic regions of Romania.

Fifteen farmers, with different levels of technology endowment and surfaces varying from 150 hectares to as much as 4000 hectares were selected to take part in this unique project. When launching the program, as a benefit for joining the exercise, each farmer received a GEOSCAN weather station, installed for the purpose of monitoring the maize parcels. The hardware was leased-in by APPR from an external provider, VANTAGE. The weather stations collect and send to the server of the application different parameters measured via the on-site sensors. The sensors always track down rainfall, wind and solar radiation information as well as soil temperature and moisture. In addition, other relevant data is collected from farmers via questionnaires and direct, on-site observations made by the project agronomist: hybrid used, successive crop, previous crop, pest control means used (molecules, rate of application, other measures), fertilizer applications, soil tillage, etc.

2 Importance of digital agriculture

Digitilisation in agriculture is very important as it brings forward modern crop monitoring technologies, such as: automatic pixel classification of satellite images and automatic processing of data received from in-situ sensors. Modern measurement and monitoring tools help farmers in rationalizing production costs and to get high yields.

Experience in the field and first-hand interaction with farmers lead to some conclusions, summarized below.

Nowadays, the importance of employing smart technologies in agriculture is paramount. This is capable to increase production and decrease input use and thus the sector's footprint on environment. The role of digitalization in helping farming to reach the F2F targets, in ensuring a decent income from agriculture, in attracting and stabilizing population, especially the young ones, in the rural areas by boosting the quality of life is well acknowledged and an over-arching goal of the Common Agricultural Policy (CAP) in the current exercise.

In response to these various needs, there are currently numerous smart solutions and applications on the market. Some of them are standalone solutions, especially designed for farm management.

Some other are being developed by input companies and offered to their clients especially tailored to manage the use of their products. This is taking a massive toll on the farmers attention and availability because they are currently using web applications from several companies and for different purposes and this aspect can lead to some extent to fatigue, especially with elderly farmers. The DEMETER application is by far exceeding the spectrum of activity of the competitor applications, but even so, sometimes getting the farmers attention comes after a series of trainings, persuasion efforts and trials.

As far as the cost of the application is concerned, this has not been identified as a major restriction in the adoption of smart farming technologies. The competition between applications is so fierce that the price has gone down considerably, with some applications even being handed to farmers for free, as a side benefit for the farmer loyalty to the respective company's products. However, most of the applications, Pilot 1.4. DEMETER provided farmers with a comprehensive and affordable solution, while feedback from users indicates that the application is flexible and user friendly.

Compared to all other applications in the market, interoperability is where DEMETER has an almost unfair advantage, as it tries to encompass almost all the aspects that need innovation around the farm, from farm inputs management to input stocks and subsidy tracking all under one application.

Optimization aimed by DEMETER Pilot 1.4 smart solution generates tangible benefits to farmers: cost reductions from using less fertilizer in the field is a relevant example, especially with the current rapid appreciations of fertilizer prices. Moreover, the work time spent in the field by the farmer has been reduced with hours weekly, which is another benefit that can be quantified. To these, an intangible benefit should be added, farmer's peace of mind.

3 Pilot Overview

Challenge

The challenge of the pilot is to help the farmers to rationalize production costs through decision support maps and management systems, providing information like crop uniformity, excess water presence, and pest impact degree resulted from extreme meteorological phenomena.

Aim

Pilot 1.4 aims to help farmers who want to rationalize their production costs and to get high yields. Rationalization of costs can be done by planting crops with different densities depending on soil nutrients, by distributing fertilizer at a variable rate and by acting in time based on warnings of the probability of disease, pests or extreme weather events.
The purpose of the 1.4 pilot is to bring forward modern crop monitoring technologies, such as: automatic pixel classification of satellite images and automatic processing of data received from in-situ sensors.

Where the pilot is being deployed and who are the partners

Pilot 1.4 is designed in partnership with the Romanian Maize Growers Association (Asociatia Producatorilor de Porumb din Romania, APPR), our agricultural specialist partner. The pilot will be implemented in locations operated by 15 agricultural farms specialized in field crops, members of APPR, covering roughly 40K hectares.

The geographical coverage will include farms located in the south of Romania that are facing natural or other specific constraints. Due to the different characteristics of chosen regions from the point of view of soil and weather, we are expecting significant variations of collected data that will allow us to better validate the concept. The maps below show the spatial distribution of the pilot parcels (magenta), and the administrative zones (NUTS 5 or LAU2) categorized in colours, based on Less-Favoured Areas (LFA) criteria.

The pilot farmers' parcels are distributed in the dark green areas, which represent areas facing natural or other specific constraints.

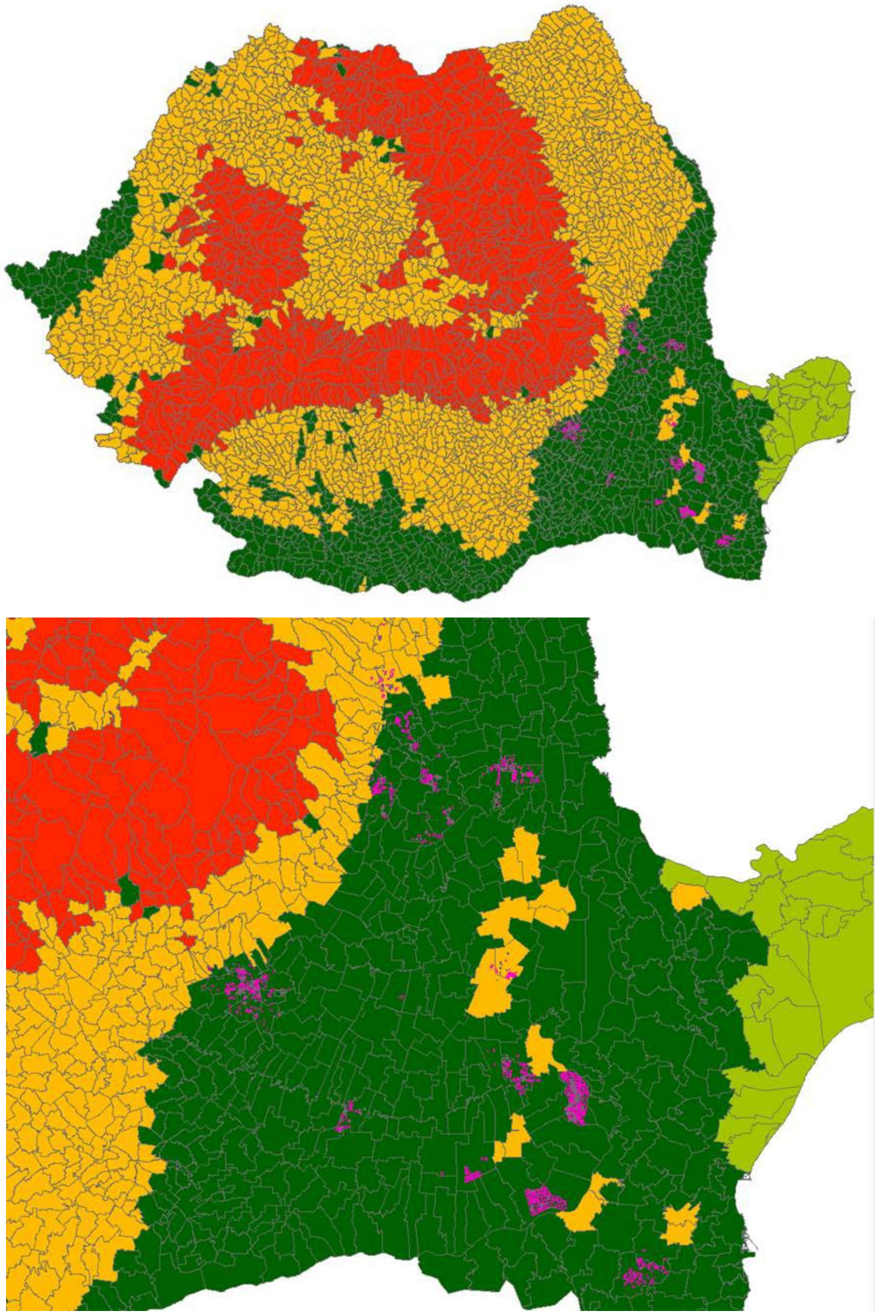


Image 1: Location of Pilot 1.4 testing parcels

Solution/Innovation

The solution consists in the development of components: A.3 Plant Stress Detection and C1. Nitrogen Balance Model that are also integrated with Inovagria.

A3 Plant Stress Detection is responsible with detection of plant stress using a combination of remote sensing data, meteorological data and in-situ data. It has the following visualisation objectives: percentage of crops affected by stress compared to total amount of crops (per crop type)

C1 Nitrogen Balance Model The component input uses NDVI images, crop coordinates, field properties and meteorological data (sensor based). Results of the analysis provide the farmers with cartographic plans and recommendations for differentiated fertilization in the same plot in order to obtain a higher yield

Improvements:

The application collects and displays the two-day weather forecast from OpenWeather for the farmer's land. The farmers can view meteorological data like: air temperature, atmospheric pressure, air humidity, atmospheric temperature, wind speed, cloudness [%], wind direction, the amount of precipitation, probability of precipitation [%], average visibility. Based on this information, they will receive recommendations for spraying.

The meteorological data collected from the weather stations installed on farmers lands are measured and displayed (air temperature, precipitation, soil temperature, humidity, wind speed, leaf wetness). The results are analysed by farmers in correlation with the other information from application (weather forecast, satellite images, fertilization information)

Based on the fertilization data input by the farmers for the corn plots, the amount of fertilizer needed to apply can be calculated and recommended.

The farmers can determine plant stress percent and localization of affected areas based on composition of the NDVI vegetation. Plant stress can come from many causes such as: burns (very high temperatures), lack of water, lack of nutrients in the soil, etc. Using modern methods to determine plant stress, effective measures can be taken to combat it.

Within Inovagria application, the valid images (which describe the greening state of vegetation) are taken from terrascopes- Sentinel 2-NDVI, for the current layer. On the Sentinel NDVI layer, the satellite images from the last download date will be displayed default, but you can select a previous date from which the image was stored. The use of vegetation spectral indices (NDVI) from collected and processed satellite images can be used to detect plant stress.

Key benefits

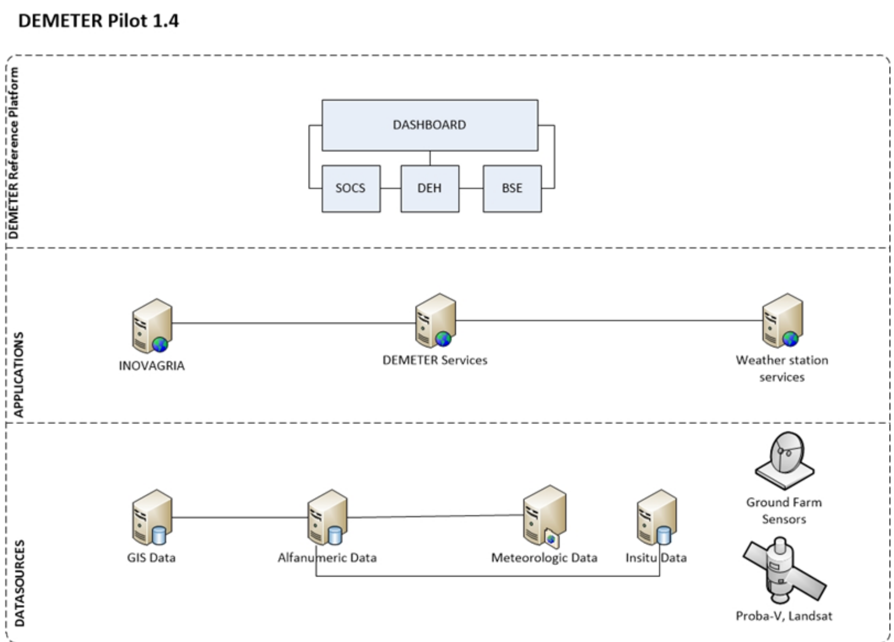
The important benefits that will be achieved by them farmers are: more information to farmers (correlated data: weather, soil properties and hybrid maturities, geo-location, etc.) will facilitate faster and more accurate decisions, real-time warnings and forecasts, increase awareness of the importance of Decision Support Systems, water use, variable rate and inputs optimization, crop works decision time improvement, Agricultural system durability stability, profit growth gain through larger and higher quality productions and maintenance of the sustainability for farming systems.

Image 2-5: Pilot in use

4 DEMETER Integration

__Key technologies employed__

Pilot 1.4 uses as inputs such as soil and weather information provided by ground sensors and weather stations or as satellite images and the different indices they offer, among others. The figure below presents a general picture of how this information is gathered through the different platforms (INOVAGRIA, DEMETER Services, weather station services), tailored to DEMETER Enhanced Entities (DEEs), and integrated into the DEH.



Input: Farm data (geographic coordinates), crop traits, used inputs, used hybrid, seeding density, soil texture, soil moisture, agrometeorological data (temperature, rainfall, leaf wetness), in-situ determination (such as Chlorophyll meter), satellite images (Proba – V, Sentinel, Landsat). NDVI index correlated with the in-situ measurements for obtaining a viable modern method to use based on satellite images. The transmission of data from the field will be done through a custom application available to farmers.

Pilot 1.4 is aiming at the optimisation of inputs, water and energy resources for maize crops. For this reason, the data it manages cover the following aspects:

Geospatial data: location, Geographical Information System (GIS) and EGNSS (Galileo/GLONASS/ GPS)

Satellite imagery: Landsat 7, Sentinel 2 (RGB, NDVI)

Climate data: Historical meteorological data and forecast.

Agrometeorological data: air temperature, air humidity, wind speed, wind direction, the amount of precipitation, soil temperature, soil humidity
In situ data: Farm crop - phenological phase, plant height, degree of plant
Forecast data: temperature, pressure, probability of precipitation, wind, clouds, humidity.

DEMETER Enablers and other technologies

- Core Enablers Used
- AIM for data exchange.
- DSS Visualisation Dashboard (Knowage).
- BSE - Brokerage Service Environment – Providing mechanism for the discovery of services.
- ACS - Access Control System – Providing Authentication and Authorisation mechanisms for the plant stress detection component.

The DEMETER enablers directly used by Pilot 1.4 are Agricultural Information Model (AIM), Semantic Interop/Mappings to AIM, Plant Stress Detection (A.3), Nitrogen Balance Model (C.1) and DSS Visualization Dashboard (KNOWAGE) and indirectly are: DEMETER Enabler Hub (DEH), Brokerage Service Environment (BSE) and Access Control Server (ACS) (called from KNOWAGE).
Other:
The output of the INOVAGRIA extension developed by SIMAVI and transmitted to the KNOWAGE platform will be important information for farmers, which will help them make faster decisions on the differentiated distribution of inputs and the optimal period for performing these works.

AIM usage from pilot perspective

Component Plant Stress Detection is responsible with detection of plant stress using a combination of remote sensing data, meteorological data and in-situ data. It has the following visualisation objectives: percentage of crops affected by stress compared to total amount of crops (per crop type)
Component A.3 needs to interact with the Security Enabler regarding user authentication.

Component A.3 Input

AIM (JSON-LD)


```
{
    "@context": [
        "https://fiware.github.io/data-models/specs/AgriFood/AgriFarm/schema.json",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context.jsonld",
        "https://w3id.org/demeter/agri-context.jsonld"
    ],
    "id": "urn:ngsi-ld:AgriFarm:b429c6d4-676f-4807-a6c9-2c6451614c09",
    "type": "AgriFarm",
    "name": "RomAgra Impex SRL",
    "description": "A smart farm producing corn",
    "address": {
        "addressCountry": "RO",
        "addressLocality": "Manasia",
        "streetAddress": "Main Street, 22",
        "type": "PostalAddress"
    },
    "contactPoint": {
        "type": "ContactPoint",
        "email": "contact@romagra.ro",
        "telephone": "0040 244 123 456"
    },
    "location": {
        "coordinates": [
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            26.67346
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        "type": "Point"
    }
}
```


Component A.3 Output

AIM (JSON-LD)


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        "https://fiware.github.io/data-
models/specs/AgriFood/AgriParcel/schema.json",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context.jsonld",
        "https://w3id.org/demeter/agri-context.jsonld"
    ],
    "@graph": [
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            "name": "RomAgra Impex SRL",
            "description": "A smart farm producing corn",
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                "addressLocality": "Manasia",
                "streetAddress": "Main Street, 22",
                "type": "PostalAddress"
            },
            "contactPoint": {
                "type": "ContactPoint",
                "email": "contact@romagra.ro",
                "telephone": "0040 244 123 456"
```

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                    26.67346
                ],
                "type": "Point"
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                    "location": {
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                        "@type": "AgriCrop",
                        "name": "Corn",
                        "description": "Glass Gem Corn",
                        "wateringFrequency": "weekly"
                    }
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                        "@type": "AgriCrop",
                        "name": "Corn",
                        "description": "Glass Gem Corn",
```

```
                        "wateringFrequency": "daily"
                    }
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                    "description": "Parcel 1c",
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                        "name": "Corn",
                        "description": "Glass Gem Corn",
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                }
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2c6451614c0a",
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            "soilTemperature": [ 14, 20, 8 ],
            "relativeHumidity": 0.15,
            "soilMoistureVwc": 0.08,
            "leafWetness": 1.0,
            "rainfall": 3,
            "windSpeed": 3.88,
            "comment": "The ir temperature exceeds the normal limits",
            "observedAt": "2020-10-13T10:00:00Z"
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            "airTemperature": [ 18, 26, 10 ],
            "soilTemperature": [ 13, 20, 6 ],
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            "soilMoistureVwc": 0.10,
            "leafWetness": 2.0,
            "rainfall": 2.4,
            "windSpeed": 3.50,
```

```
            "comment": "Soil moisture is too low, needs daily irrigation",
            "observedAt": "2020-10-20T10:00:00Z"
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            "soilTemperature": [ 10, 16, 4 ],
            "relativeHumidity": 0.10,
            "soilMoistureVwc": 0.05,
            "leafWetness": 1.3,
            "rainfall": 4.2,
            "windSpeed": 3.00,
            "comment": "Plants are happy!",
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        {
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}
```


Component Nitrogen Balance Model estimates crop nitrogen requirements and provides the scheduling for fertilization. The component input uses NDVI images, crop coordinates, field properties and meteorological data (sensor based). Results of the analysis provide the farmers with cartographic plans and recommendations for differentiated fertilization in the same plot in order to obtain a higher yield.
Component 4.C.1 will predict and interact with any other component or DEMETER Enabler. The component is the “Pattern Extraction for Optimal Fertilizer Usage".
Also, the component needs to interact with the Security Enabler regarding user authentication.

Component 4.C.1 Input

AIM (JSON-LD)


```
{
    "@context": [
        "https://fiware.github.io/data-models/specs/AgriFood/AgriFarm/schema.json",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context.jsonld",
        "https://w3id.org/demeter/agri-context.jsonld"
    ],
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    "@type": "AgriFarm",
    "name": "RomAgra Impex SRL",
    "description": "A smart farm producing corn",
    "address": {
        "addressCountry": "RO",
        "addressLocality": "Manasia",
        "streetAddress": "Main Street, 22",
        "type": "PostalAddress"
    },
    "contactPoint": {
        "type": "ContactPoint",
        "email": "contact@romagra.ro",
        "telephone": "0040 244 123 456"
    },
    "location": {
        "coordinates": [
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            26.67346
        ],
        "type": "Point"
    },
    "hasAgriParcel": [
        "urn:ngsi-ld:AgriParcel:b429c6d4-676f-4807-a6c9-2c6451614c0a"
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}
```


Component 4.C.1 Output

AIM (JSON-LD)


```
{
    "@context": [
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models/specs/AgriFood/AgriParcel/schema.json",
        "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context.jsonld",
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```

```
            "location": {
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                                [16.398897171020510, 52.289202594763935],
                                [16.399948596954350, 52.290948204783690]
                            ]
                        ]
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                        "name": "Corn",
                        "description": "Glass Gem Corn",
                        "wateringFrequency": "daily"
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                                 [16.398897171020510, 52.289202594763935],
                                 [16.399948596954350, 52.290948204783690]
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                    "name": "1c",
                    "description": "Parcel 1c",
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2c6451614c52",
                        "@type": "AgriCrop",
                        "name": "Corn",
                        "description": "Glass Gem Corn",
                        "wateringFrequency": "other"
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            "description": "Previous fertilization for parcel 1a",
            "hasAgriParcel": "urn:ngsi-ld:AgriParcel:b429c6d4-676f-4807-a6c9-
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                "@type": "AgriProductType",
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                "agroVocConcept": {
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                "root": "true"
            },
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            "status": "finished",
            "reportedAt": "2020-10-13T10:00:00Z",
            "comment": "1 dose of 100kg of urea"
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            "description": "Previous fertilization for parcel 1b",
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2c6451614c0b",
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            "reportedAt": "2020-10-13T10:00:00Z",
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2c6451614c5f",
            "@type": "AgriParcelOperation",
            "description": "Previous fertilization for parcel 1c",
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                "root": "true"
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            "comment": "1 dose of 150kg of urea"
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2c6451614c70",
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            "weatherType": "sunnyDay",
            "temperature": 24,
            "windSpeed": 2.8,
            "precipitationProbability": 0.15,
            "validFrom": "2020-10-21T00:00:00Z",
            "validThrough": "2020-10-22T00:00:00Z"
        },
        {
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2c6451614c70",
            "@type": "WeatherForecast",
            "weatherType": "lightRainShower",
            "temperature": 20,
            "windSpeed": 3.5,
            "precipitationProbability": 0.80,
            "validFrom": "2020-10-22T00:00:00Z",
            "validThrough": "2020-10-23T00:00:00Z"
        }
    ]
}
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Figure 1: Importance of DEH registration from pilot perspective. Component 4.A.3 Plant Stress Detection

Dashboard Widget

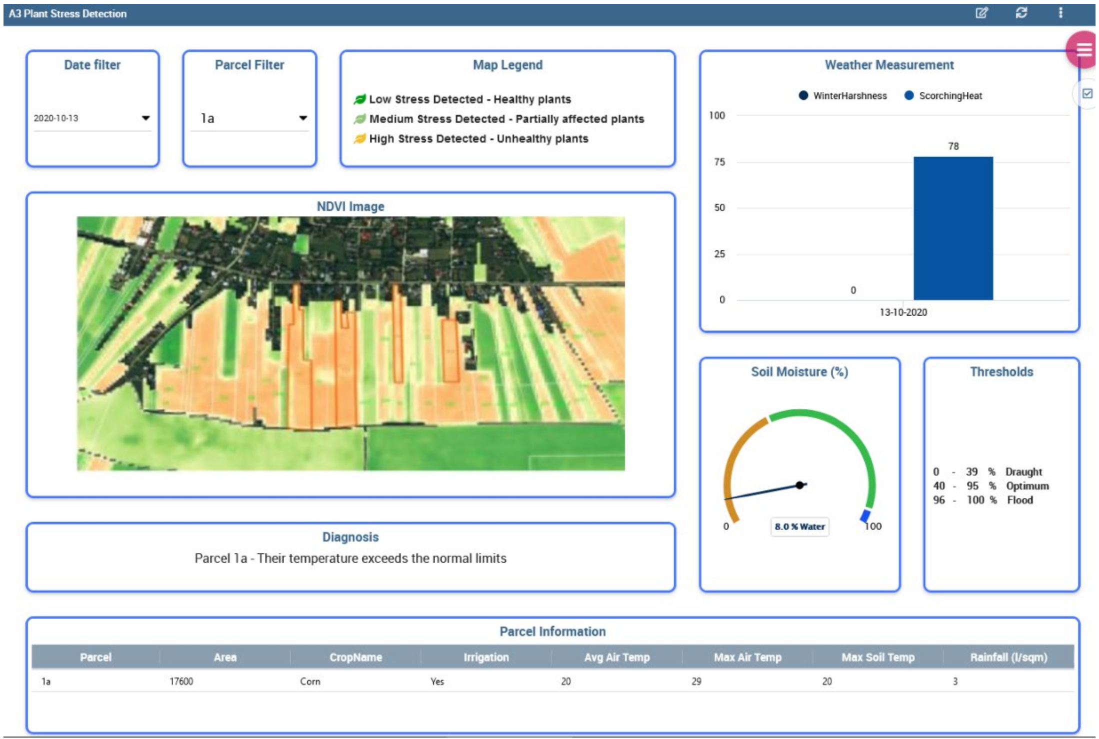

Image 6: Dashboard widget

The dashboard will contain a map widget showing different levels of stress in the same plot. This map will be obtained from NDVI images (Terrascope) by using the pixel classification method. Therefore, the image will be differentiated according to the stress level of the plants. Stress can be due to lack or excess of water or very high temperatures, over several consecutive days.

Based on this map, it will be easier to identify problem areas and it will be possible to go to the field and act directly with the necessary treatments.

The weather measurement widget indicates the scorching heat and winter harshness units based on the temperatures received from the agrometeorological station installed in the respective plot. The determination of the indices is based on an algorithm for gathering consecutive days with degrees exceeding the threshold of 32 degrees - in summer or which are below the freezing threshold of -10 degrees in winter.

The soil moisture widget together with thresholds graphically indicates the volumetric water content in the soil for the selected parcel.

The diagnosis textbox widget will display a text with the diagnosis according to the data received from weather station, forecast and Terrascope, that will indicate if there is any stress in the plot.

Dependencies (either internal to DEMETER or bound to the pilot):

1. Terrascope Satellite Imagery Service.
2. WatchItGrow.be – NDVI pixels classification into polygons (from VITO partner).
3. OpenWeather.com – Weather forecast service.

Security Usage (Data & User)

4.A.3 - Plant Stress Detection component will make use of the DEMETER ACS to ensure security for both the user and data managed by the component.

Current Status

Feature	Short description	Status
DSS Visualisation Design	Mock-ups of the Knowage visualisations that will be produced for the plant stress detection component	Done
Integration with DEH, BSE, ACS	Register this service to BSE, DEH and integrate it with ACS and Knowage	Done

5 Feedback from farmers

Apart from the farm visits APPR team paid regularly to farmers in order to develop and improve the application, interaction, collection and exchange of ideas was facilitated on the occasion of several conferences within our farmer community and on every occasion deemed suitable.

DEMETER and its advantages have been communicated broadly on field days and social events that organized along the way, to name just a few: the APPR annual congress (a flagship event which takes place every February, with 200-300 persons in the audience, where farmers, input producers and service providers, national authorities and media reps attend); the Maize Day, which brings together more than 1500 farmers yearly; the Agricultural Fair - FarmConect Romania 2022, which brought together at its first edition more than 5000 actors from agriculture as a whole, and where a special panel discussion was dedicated to "Digital transformation of agriculture", with a joint SIMAVI – APPR presentation (10K views on FarmForum page).

Also, APPR conducted online sessions with several input providers who also develop digital solutions (Vantage, Bayer, Corteva) as well as with researchers in Crop Protection to identify digitalisation barriers and perspectives in Romania.

The farmer surveys were disseminated widely within the Romanian Alliance for Agriculture and Cooperation, resulting in a high rate of response from Romania.

This digital solution is developed in order to help agriculture thrive and be future-proof in these times of economic uncertainty, however what we are sure of is that the farmer is the main actor we have to be focusing on. Therefore, interactions with farmers have been crucial in developing a resilient algorithm and a friendly interface of the farm management application because of the help we got from their field expertise, knowledge, and feedback.
To set an example, every time the APPR team travels to farms and interacts with agronomists, different aspects that can improved are identified, either on an algorithmic level or a functionality one. Afterwards, the information gathered from farmers is fed to the technology partner SIMAVI, who tries to implement as much as possible to cover the needs of the end-user.

6 Benefits

The main advantage the farmer gets from using Pilot 1.4 digital solution the improvement in resource allocation, as he will have a database of inputs available all the time. This will naturally bring down the cost of production but will also allow him to adopt sustainable practices.

Secondly, measurements (plant stress detection, nitrogen level and distribution, etc.) in the field are a must if you desire to be a performant producer. The downside of those measurements is that, for large surfaces of land, measurements take a lot of time and cannot be done uniformly across all the plots, time that can otherwise be used for other productive reasons. Therefore, with the help of the application, the farmer reduces the time needed to check his crops and do it from the comfort of his office desktop.

List of pilot specific KPIs with short description, time bond and target

1. Reducing the time spent in the field for the identification of the areas with crop development and fertilization issues:
    - Beginning of the project: 240 minutes/1 ha
    - At the moment it takes less than 10 minutes to evaluate any plot within the farm

2. Reducing the amount of inputs (fertilizers) by applying a variable rate, according to the specific needs:
    - The starting fertilizer rate was around 150 kg/ha of nitrogen for every plot.
    - The current fertilizer rate is less than 140 kg/ha of nitrogen as an average.

3. Accurate calculation of the fertilization rate based on the agronomic formula which has as parameters: crop type, targeted yield, soil type, previous crop:

- The starting fertilizer rate was around 150 kg/ha of nitrogen for every plot.
- The current fertilizer rate is less than 140 kg/ha of nitrogen as an average.

4. Stress rate calculation (the percentage of the crop damage rate):

- More than 120 minutes/1 ha in the beginning of the project.
- Less than 10 minutes with the provided technology

5. Calculation of the surfaces with the lowest nitrogen level in the parcel.

- 480 minutes/1 ha in the beginning of the project
- Less than 10 minutes with the provided technology

7 Conclusion

Pilot 1.4, IoT Corn Management & Decision Support Platform is being very beneficial in terms of helping farmers to rationalize maize production costs, determine plant stress, get maize production hight yields, better nutrient management, fertilizer quantity calculation for corn crop and establishing the optimal fertilization period based on the weather forecast.

Being involved in DEMETER project, the pilot benefits from the necessary resources to accomplish the established objectives. The pilot uses as inputs such as soil and weather information provided by ground sensors and weather stations or as satellite images and the different indices they offer, among others. This information is gathered through the different platforms (INOVAGRIA, DEMETER Services, weather station services), tailored to DEMETER Enhanced Entities (DEEs), and integrated into the DEH.

demeter

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