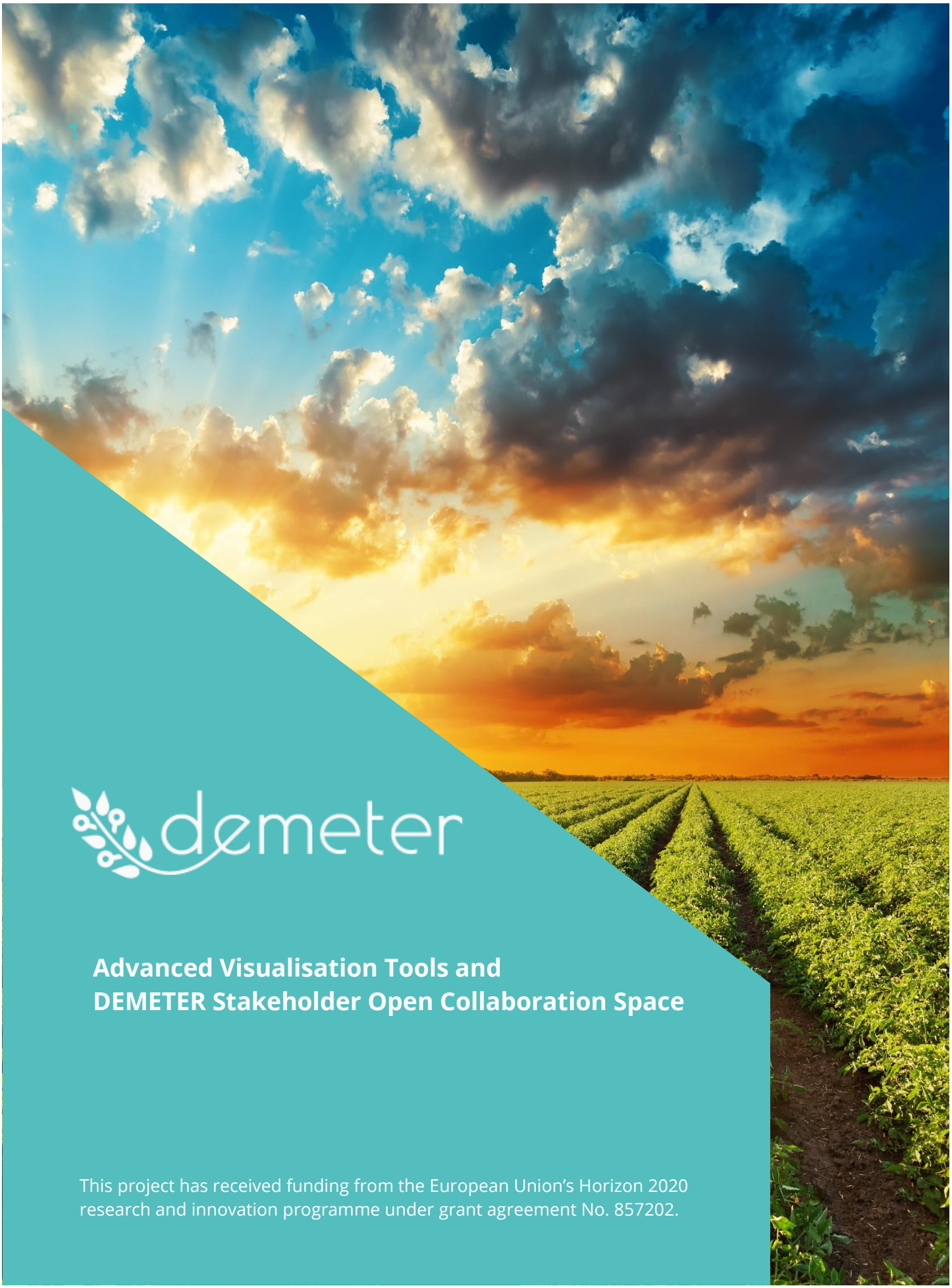

Advanced Visualisation Tools and DEMETER Stakeholder Open Collaboration Space

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Advanced Visualisation Tools and DEMETER Stakeholder Open Collaboration Space

1 Summary

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, 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.

To achieve these objectives, and promote the targeted technological, business, adoption and socio-economic impacts, DEMETER will develop decision support system (DSS) components that will enable the delivery of tailored advisory services to the agricultural sector. These will combine data analytics with AI-based expert system, machine learning and benchmarking techniques to provide precision decision support to the users.

This white paper defines the Knowage based, data visualization module, which will provide an intuitive interpretation to the users, and the implementation of the SOCS, where initial steps will be taken to describe this space for collaborating, sharing of best practices, and participating in the co-creation processes. This collaboration space makes a farmer's needs visible to advisors and developers.

2 Adaptive Visualisations for Dashboards

Data visualisation provides an intuitive way to interactively explore and analyse data, enabling the identification of interesting patterns, and the inference of correlations and causalities. Current visualisation and exploration systems should effectively and efficiently handle Real-time Interaction, On-the-fly Processing, Visual Scalability, User Assistance and Personalisation.

An increasingly large number of users of different skill levels explore and analyse data in different sectors e.g., farmers need to process lots of disparate data which drive agricultural production and livestock management.

The technology selected to provide visualisation in DEMETER is Knowage; an open-source suite developed by ENGINEERING that combines traditional data and big data sources into valuable and meaningful information. Knowage provides advanced self-service capabilities allowing the end-user to build his own analyses, get insights on data, and turn them into actionable knowledge for effective decision-making processes. The software is flexible because it adopts open standards and can be used in various environments without considerable requirements.

Knowage offers different ways of integration with existing platforms through a whole series of data The UI design started with Pilots designing the reference DSS interfaces using a mock-up.

The integration of the analysis software components or algorithms that produce the output data for the DSS interfaces, will connect to Knowage through the REST data sets (or through the embedded functions represented by the analytical drivers made available through Knowage function catalogue); the output indicators extracted from the algorithms will feed the Knowage dashboards and the data will be graphed within the cockpit.

This approach involves generating general-purpose dashboards and not a mirror copies of the DSS interface that the pilot originally had, but a common interface as much as possible for the pilots involved in a specific DSS area. Figure 1 shows this generic approach for all Pilots who intend to connect their data with the data visualisation framework:

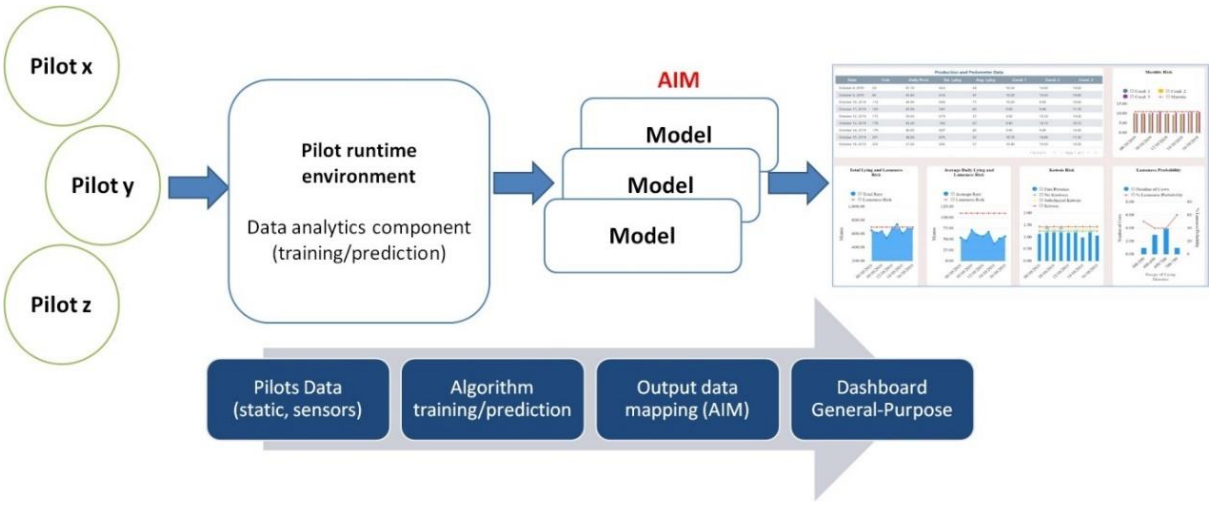

Figure 1: Pilot DSS tuning information flow

The analytical components are run in their target environment in both the training and prediction phases, using pre-cleaned data from the sources (sensors, databases, static data etc.). Depending on the type of service and the output produced, Knowage may be able to select the most appropriate DSS interface or dashboard, showing the end user the result of the processing.

3 Stakeholders Open Collaboration Space (SOCS)

3.1 Introduction

SOCS is a space **dedicated to all stakeholders** (farmers, advisors, and suppliers) where they can **collaborate, share best practices, and participate in co-creation processes**. This collaboration space makes a farmer's need visible to advisors and developers and conveys the information coming from the farmers as input to select the most suitable resources registered in the DEMETER Enabler Hub to build the optimal solution. SOCS supports knowledge sharing, lessons learnt and co-creation of solutions, based on human-to-human interaction, communication, and technology information.

SOCS aims to "put farmers fully in control of their needs, of their choices, of their speed of adoption of solutions, of their data" and represents a response to their need **to be supported when they have to choose between different solutions, to be aware about the compatibility/interoperability of a solution with their legacy systems and to trust in data sharing**.

SOCS is based on well-established technologies, which give a set of basic services and tools to create, share and find content, information, knowledge, experts, and ideas as well as to manage collaboration effectively and productively.

3.2 The interactive innovation model

In DEMETER, the interactive innovation model is implemented through the Multi-Actor Approach (MAA) which puts "farmers fully in control of their needs, of their choices, of their speed of adoption of solutions, and of their data", and "reverses the relationship between farmers and providers" since "farmers define their needs together, individually or with advisors", "suppliers collectively and individually, share the responsibility of elaborating one (or more) solutions to answer the need" and "the solutions made are comparable based".

In the overall agriculture scenario, farmers must face a lot of difficulties related to:

- **Assess the Return on Investment** ascribable to digital innovations.
- **Trust the technology** and IT providers.
- **Trust in data sharing**.
- Understand about **compatibility/interoperability** with current solutions.
- **Choose between different solutions** without a clear logic between benefits, features, and economic models.
- **Being locked in with one vendor**.

In this scenario, the SOCS Platform represents a support facility that helps farmers to become more competitive by improving their business/production processes as well as product quality and yield by means of digital technology. SOCS will include a wide range of features that, together, deliver the Knowledge-driven services and Collaboration Services to its users, structuring the human-in-the-loop dimension of DEMETER.

3.3 SOCS: The Innovation and Collaboration platform for DEMETER

The relationship between farmers, society and the rural world is changing due to diminishing resources, growing populations and pressure on the environment. It is for these reasons that farmers need new knowledge and innovative ideas to develop and manage smarter and more sustainable production systems. Approaches to knowledge exchange, learning and innovation in agriculture are rapidly evolving and the emerging need is to adapt to this new context. Nowadays, knowledge is co-created by farmers, scientists, suppliers, advisers, enterprises, non-profit and associations etc. and, through new ways to share knowledge and expertise, is possible to keep agriculture and food production competitive and rural areas vibrant in the 21st century.

Farmers can use SOCS to define their needs together, individually or with the support of advisors, while IT providers, collectively and individually, share the responsibility of elaborating one (or more) solutions to answer farmers need. Table 1 shows the three expected users and their needs as already identified by DEMETER.

Farmers	• Define their needs. • Access to advisor support. • Access to potential collaborators/new partners. • Co-design new solution based on their needs. • Share experiences. • Access to agricultural experiments. • Exchange knowledge. • Joint events.
Advisors	• Access to potential collaborators/new partners and customers. • Increase knowledge. • Joint events. • Access to success stories. • Support the farmers in the design of new solution that match farmers' need.
IT providers	• Learn about new software/networking standards, technologies and methods that are specific to the agriculture domain, while examining their benefit and applicability. • Access to potential collaborators/new partners and customers. • Access to new technology. • Co-design solution with farmers and advisors. • Increase knowledge. • Access to success stories. • Joint events.

Table 1: SOCS users and needs

The SOCS services available may be categorized under three pillars:

- The **Collaboration space** is a set of tools useful to share, validate ideas and co-design new solutions.
- The **Catalogues** are a common repository for human profiles and competencies, to discover who is part of the network and look for collaborators/partners in the new solution design.

- The **Knowledge Management** provides online access to information and materials, and content-based (data, information, knowledge) and organizational outputs (e.g., advice, answers, facilitation, practices).

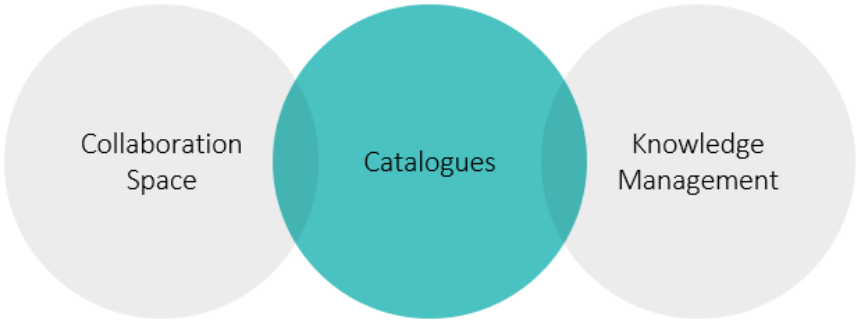

Figure 2: SOCS main components

In the following picture, more details about the SOCS portfolio of services are shown. Moreover, cross functionalities support the general mode of operation, these are: Universal search functionalities and notification services.

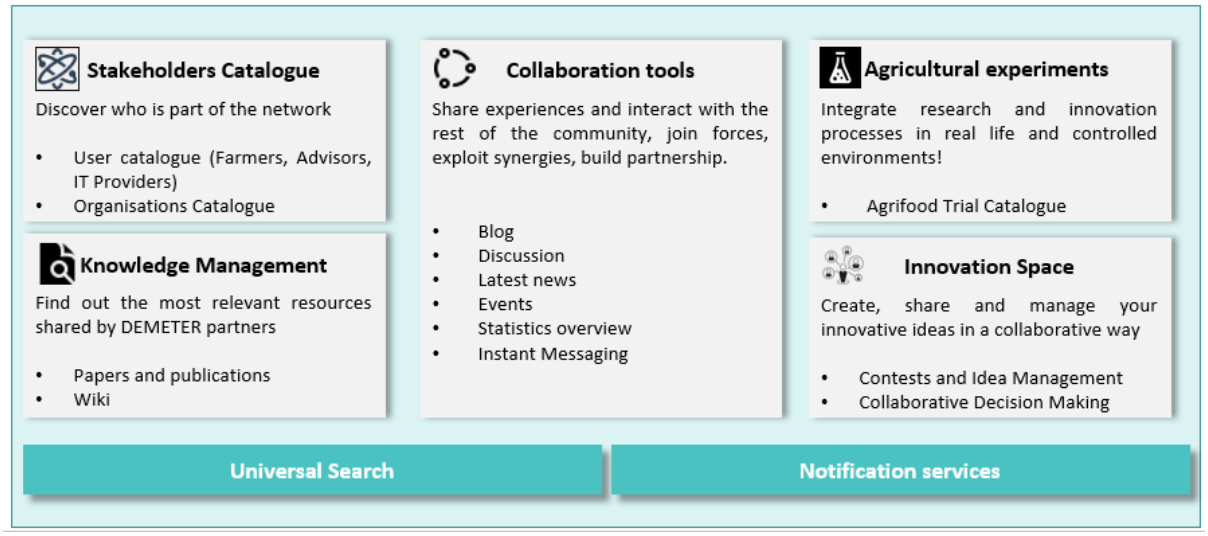

Figure 3: SOCS Portfolio of services

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