D7.3 - FOOD SECURITY COMMUNITY-CENTRED ASSESSMENT PLAN

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ACRONYMS LIST

API	Application Programming Interface
ESFRI	European Strategy Forum for Research Infrastructure
FAIR	Findable, Accessible, Interoperable, Reusable, as set of principles acting as an international guideline for high quality data stewardship
FAO	Food and Agriculture Organisation of the United Nations
NGOs	Non-Governmental Organisations
RDF	Resource Description Framework
SQL	Structured Query Language
VRE	Virtual Research Environment

EXECUTIVE SUMMARY

This Community-centered Assessment Plan describes a detailed plan regarding the procedures to be carried out for assessing the effectiveness of the AGINFRA PLUS paradigm for research in Food Security communities. It defines the objectives of the pilot trials and their assessment. Is also defines the different actions defined in the piloting scheme including the organization of restricted or wider demonstrations and hands-on events, activation of networks, expert sessions, etc. Furthermore, the task will carry out the pilot execution and evaluation activities relative to Food Security foreseen in Task 7.1 and following the established plan and evaluation methodology.

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1 INTRODUCTION

The "Food Security" use cases to be implemented in the AGINFRA PLUS VRE should leverage the Big Data opportunities in order to sustainable maximize crop performance. That requires being able to determine for instance which plant species and which varieties are most adapted to global changes and natural resource preservation. The Food Security community requires high throughput phenotyping, which is at the heart of plant selection process and produces huge sets of complex data. This plan describes a user-centered assessment plan for the AGINFRA PLUS VRE for the Food Security community. It describes the levels of assessment that will be performed to evaluate a heterogeneous set of quantitative and qualitative indicators.

The objectives for the pilots and the associated pilot assessments deal with the different steps of data processing and analysis, including:
- Discover and access resources
- Exchange plant datasets at different scales (gene, cell, plant, canopy, crop), at different steps (phenology, food processing), environmental datasets (soil, water, life cycle and sustainability), nutrition and biomass production datasets etc.
- Combine, integrate and (pre-) process these variable and huge datasets
- Explore, analyse, model, visualize
- Record the data processing chain in order make it reproducibility

The goal of this document is to describe the procedures to be carried out for assessing the effectiveness of the AGINFRA PLUS VRE in dealing with all these steps. During the assessment phase, we will focus on a set of evaluation indicators for biological questions in environmental stresses such as water stress in the case of wheat species. The assessment plan will include various activities and events such as surveys, trainings, and workshops.

2 ASSESMENT METHODOLOGY

This part defines how the project intends to expose the use case, how it interacts with the Food Security community in the various phases of the project through targeted sessions and events and how the evaluators involved in each phase match the objectives of every phase. Moreover, it defines the setup of the trials and the associated evaluation procedures and metrics used to measure the effectiveness of the AGINFRA PLUS paradigm for research in the targeted research community. These cases will be more focused on high-throughput phenotyping.

2.1   INTERACTION WITH COMMUNITIES

To assess the effectiveness of the AGINFRA PLUS paradigm for the Food Security community, an iterative approach of assessment, according to the proposed three-phase piloting scheme, will be performed. Following the concept of gradual extension of functionality, intended audience and assessment of this scheme, the pilot will interact with the community and the pilot evaluators accordingly.

First Pilot (initial phase, M13-18)

In order to gather and to analyse needs and requirements, events (such as VRE training) will be organized with partners of WP 2, 3 and 4 (core e-infrastructures), different stakeholders, and various representative users. To start with, we will select around 5 complementary representative persons (a training group) of the phenotyping community to form the testing group. Next, we will organize a workshop with these representatives during which we will introduce the concept of the VRE to the training group. Then we will collect the expectations, requirements and fears of the training group regarding the future Food Security VRE.

Available components will also be evaluated by a couple of potential users who don't know how to use the VRE. They will have to follow a user scenario and evaluate every available feature.

Second Pilot (intermediate phase, M22-M27)

In addition to traditional indicators such as performance and scalability, the iterative assessment of the Food Security VRE in AGINFRA PLUS will take into account the difference between AGINFRA PLUS and the expectations and requirements of the training group on selected trials. We will also organize a joint event with the other use case related work packages and the technical work packages in order to challenge and improve our approach.

Third Pilot (summative phase, M30-M36)

We will implement the final product indicators on the expectations and requirements of the Food Security community (such as FAO, NGOs, ESFRI EMPHASIS, etc.). These indicators should reflect the level of access to relevant resources (data, tools, etc.), ergonomics considerations, and the value for end-users of AGINFRA PLUS.

We will interact with different sub communities within the plant community (Emphasis-prep partners), including geneticists, eco-physiologists, agronomists, bio-climatologists, soil researchers, computer scientists, and data scientists. The final version of the prototype for the use case will be exposed and processed. We will interact with core e-infrastructures during this phase.

2.2 PILOTS TRIALS

First Pilot (initial phase, M13-18)

The first pilot trials will focus on the assessment of the usability of the Food Security VRE available features, especially on data and analytics scripts sharing. This first evaluation should help us to see if necessary features are missing or on the contrary some features seem useless for the purpose of the phenotyping community. The first pilot will also be a good opportunity to communicate and introduce the VRE concept to this community.

Second Pilot (summative phase, M22-M27)

The second pilot will focus on the assessment of connection of the Food Security VRE with the main data sources described in the deliverable D7.1, particularly the data sources in relation with the trial question: which varieties of plant species are the most adapted to environmental stresses such as water deficit. The emphasis will be on the availability and accessibility of effective components for the VRE and the connectivity requirement and the associated environment (such as data discovery functionality, data semantic) for further integration of workflows.

Then we will make sure that all the resources (algorithms, tools, etc.) required to process and analyse the data are available in the VRE. Based on a datathon with the plant community (geneticists, eco-physiologists, agronomists, bio-climatologists, soil researchers) alongside with computer scientists and data scientists, to evaluate how well the Food Security VRE in AGINFRA PLUS contributes (or not) to answering questions of interest. Scalability of workflows will be assessed for large-scale datasets produced by high throughput plant phenotyping. Decision support scenarios will be tested.

Third Pilot (summative phase, M30-M36)

The third pilot aims to measure the gap between the expectations of the testing group and the possibilities given by the VRE, and will be performed by a group of international researchers. The following aspects will be assessed: usability and performance of workflows. The assessment will focus on the ability to discover data sources and access to relevant data, the interoperability of outputs (with regard to linkage, e.g. with post-processing and visualization tools) and both usability and adaptability of workflow components (data analytics and visualization). This pilot phase will focus on indicators that need to be assessed in a limited time-frame and with the heterogeneity expertise levels that can be expected in international community events. Like in other use cases, it will therefore focus in first instance on assessing the usability and effectiveness of pre-configured workflows and some attention to perform specific associated analytics and visualization components. Nevertheless, targeted evaluators will be asked if they are willing to perform a deeper and more time-consuming assessment of a use case, taking into account and complementing the evaluation data for some parts of the assessments that were defined for the 2nd pilot trial phase.

2.3 PILOTS EVALUATION

The assessment of the accessibility, connectivity (with regard to the foreseen prototype and its application) and performance of data sources required for the use case on the VRE. The evaluation of the VRE will include two parts: a global evaluation, and an evaluation of the gap between the specific expectations of the testing group and the functionalities of the VRE. The global evaluation will include (but not be limited to) indicators from the following table:

Table 1: Indicators for global evaluation

Indicator	Examples	Assessment method	Phase
Conformity	Are pilots processing and results conforming to user expectations and quality standards?	Interviews and confrontation with existing tools	1, 2, 3
Ease of Use	Guidance of the environment. How simple is the concept of a VRE to the user; how easy is it to use D4Science or EGI? How much effort is needed to define or use workflows? How much effort does it take to develop workflow components? Data preparation: does the VRE have a significant array of coding or non-coding features, such as for data transformation and filtering, to prepare data for modelling? Data exploration and visualization: does the VRE allow for a range of exploratory steps, including interactive visualization?	End user survey	1, 2, 3
Learning Curve	How much time is needed to learn new concepts etc. before the VRE can be used?	Expert review	1, 2
Usefulness	How can the use of VRE be compared to current use of hardware and software?? E.g. considering costs, functionality? User interface: does the VRE have a coherent "look and feel," and does it provide an intuitive UI, ideally with support of a visual component for the design of workflows?	End user survey, Expert review	1, 2, 3
Performance, Scalability	How does performance of the VRE compare to current systems in use? How significant is increased performance? Is the VRE fast enough for day-to-day use? How flexible is the VRE in scaling up compute and storage?	Expert Survey, Benchmarking	2, (3)
Reliability	Is the VRE (and infrastructure) reliable enough for day-to-day use? How much downtime is acceptable?	Expert review	2
Openness	How easy is it to add new data and functionality to the VRE? How easy is it to share workflows, components, and data?	Expert review	1, 2
Transparency	How repeatable are workflows? Does the VRE have version control and for workflows, components, data?	Expert review	2, (3)
Support	Use issue support and environment correction and adaptation delay and efficiency. Flexibility, extensibility and openness: How can open-source libraries be integrated into the VRE? How can users create their own functions? How does the VRE work with notebooks?	Expert review	2, 3

Collaboration	How do users with different skills work together on the same workflows and projects? How can projects be archived, commented on and reused?	Panel of representative users	2, 3
Resources optimisation	What management capabilities does the VRE provide (such as for security, compute resource management, governance, reuse and version management of resources, auditing lineage and reproducibility)?	Panel of representative users	2, 3
Consistency	How consistent and integrated is the VRE to support an entire data analytics pipeline? Does the VRE itself provide a seamless end-to-end experience, to make the users more productive across the whole data and analytics pipeline? This meta-capability includes ensuring data input/output formats are standardized wherever possible, so that components have a consistent "look and feel" and terminology is unified across the platform	Panel of representative users	2, 3
FAIR-ness	How does the VRE help in making research data and algorithms FAIR (Findable, Accessible, Interoperable, Reusable). What are advantages and disadvantages compared to e.g. current research environments and data management practices? How well does the VRE support access and integrate data from various data sources and of different types (textual, SQL, RDF, images, location data, etc.)?	Expert review	1, 2

A more detailed description of the case specific user audience and the objectives of the pilot assessment are provided in the following chapters.

3 USE CASE ASSESSMENT

The use case "Food Security" is defined in deliverable D7.1 (User-driven Requirements & Use Cases – Food Security) as a use case on Food Security with a focus on high throughput plant phenotyping. The main challenge is to design and implement scientific workflows on massive amounts of complex data produced at different scales (population, plant, organ, cells, etc.), different stages (sowing, phenology, harvest) in interaction with various environment components (soil, climate, agricultural practices, biodiversity, etc.). In order to achieve this aim, we must supply analysis combining various heterogeneous data sources and run scientific workflows on a set of datasets, potentially huge and potentially from different data sources. The given workflow may include some steps of data combination and wrangling.

3.1   TARGET USERS

Typical users of this use case will be (see deliverable 7.1):
- Researchers
- Breeders
- Stakeholders (states, farmers' representatives, governmental experts, private companies)
- Engineers
- "Data professionals" (Data scientists, Data analysts, Data managers)

3.2   ASSESSMENT OBJECTIVES

The principal objective for this use case is to characterize, in a background of global changes, an environment and see in return which species and variety are likely to adapt to this specific environment. To that aim, the user should be able to use the Food SecurityVRE to import, build, and update workflows to:
- Search for, and access, environmental and experimental data which might be large. The main data sources are the different instances of the EMPHASIS information system (currently under development) which will be accessible through web services.
- Choose the variables that characterize a given environment.
- Identify the varieties or species that can adapt to the characterized environment.
- Share the results with decision makers through a user-friendly interface so they can decide which species or varieties they want to put in a given environment.

The VRE should allow access control to the data sources and the shared objects (workflows, models and results of workflows). The global assessment will include but not be limited to develop and improve the following:
- Data access: access and integrate data from various data sources of phenomics platforms with a focus on semantic issues.
- Data exploration and visualization: to provide interactive visualization.
- User interface: the VRE must provide coherent "look and feel" and support for a visual component for the design of workflows.
- Machine learning: access to machine-learning approaches and also include support for modern machine-learning approaches like ensemble techniques (boosting, bagging and random forests) and deep learning.
- Flexibility, extensibility and openness: Integration of open-source libraries into the VRE. Work with notebooks should be allowed.
- Delivery: Ability to create APIs or containers (such as code, Predictive Model Markup Language [PMML] and packaged apps) that can be reused.

- Resource management: management of data and tools. Provide reuse and version management of resources, auditing lineage and reproducibility).
- Collaboration: Make users with different skills work together.
- Coherence: provide a seamless end-to-end experience, to make the users more productive across the whole data and analytics pipeline.

3.3   ASSESSMENT INDICATORS

According to the other use cases, the development of the evaluation procedures for the use case will, aligned with the iterative approach of the pilot trials, be developed in a phased way. The relevant indicators from the set as described in the previous section, and the methods of assessment in the different phases, will then be further specified. The level of complexity of workflows can be completed on a given set of datasets. The size of the datasets that the VRE enables to deal with is another quantitative indicator.

4 TENTATIVE PILOT TRIALS SCHEDULE

The execution of pilot trials will start after the completion of the development of required components through WP2, WP3 and WP4.

The overall schedule for the Food Security pilot is the following:

Table 2: The overall schedule for the Food Security pilot

Time Frame	Activity
Q3 & Q4 2017	Forming the testing group
Q1 & Q2 2018	First workshop of the testing group Objective: Introduce the concept of VRE First test of the VRE by new potential users
Q3 & Q4 2018	Survey
Q1 & Q2 2019	Datathon
Q3 & Q4 2019	End of evaluation