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ACRONYMS LIST

FAIR	Findable, Accessible, Interoperable, Reusable, as set of principles acting as an international guideline for high quality data stewardship
SAI	Statistical Algorithms Importer
VRE	Virtual Research Environment

EXECUTIVE SUMMARY

This document describes the first pilot evaluation procedure on the VRE developed for the Food Security community and reports on the outcomes of the evaluation.

The report starts with a short explanation of the pilot evaluation's main objectives, considering the specific scope that was defined in the community centered assessment plan (deliverable D7.3) for the first pilot phase. It describes the evaluation procedure based on the indicators presented in D7.3 and reports the results of the first evaluation phase.

TABLE OF CONTENTS

1 INTRODUCTION 8

2 PILOT EVALUATION – OBJECTIVES AND PROCESS 9

3 EVALUATION INDICATORS 11

3.1 EASE OF USE 11

3.2 LEARNING CURVE 11

3.3 USEFULNESS 11

3.4 OPENNESS 11

3.5 FAIR-NESS 11

4 EVALUATION PROCEDURE 12

4.1 FIRST GLOBAL EVALUATION 12

4.2 NEW USER EVALUATION 12

5 EVALUATION REPORT 14

5.1 FIRST GLOBAL EVALUATION REPORT 14

5.2 NEW USER EVALUATION REPORT 14

5.3 CONCLUSIONS AND FOLLOW-UP ACTIONS 16

ANNEX 1 – EVALUATION SCENARIO 17

ANNEX 2 – FILLED EVALUATION SHEETS 19

LIST OF TABLES

Table 1 - List of evaluation indicators for the Food Security VRE use cases 9
Table 2: Notation table provided to the testers 13
Table 3: Mean of each mark given by the 2 users that did the evaluation 14
Table 4: Results of the tester that didn't attend the VRE workshop 19
Table 5: Results of the tester that attended the VRE workshop 20

1 INTRODUCTION

The Food Security use case in the AGINFRA plus VRE is high-throughput phenotyping that aims to select plant varieties that are best adapted to global changes. High-throughput phenotyping platforms produce a large amount of heterogeneous data (images, sensors data, etc.). The first need of this community is the easy access to these data from different platforms, but also access to external data resources such as public repositories. They also need to exchange their results with other phenomics scientists who can work on the same specie or even the same variety.

Several initiatives have been launched such as the French project Phenome or the European project Emphasis. The goal of these projects is to facilitate the collaboration between phenotyping platforms. This confirms the need of a collaborative working environment in the phenomics community.

In order to examine if a VRE (Virtual Research Environment) can meet these expectations, the Food Security VRE has been deployed into the D4Science platform.

The goal of this document is to provide evaluation results collected through the performed pilot evaluation as it was defined in the deliverable D7.3.

First, the objectives of the evaluation are outlined. Then, the indicators used for the first evaluation are presented as well as the detailed evaluation procedure which takes into account the current state of the VRE development. Finally, the document provides a summary of the evaluation results.

2 PILOT EVALUATION – OBJECTIVES AND PROCESS

In order to assess the effectiveness of using a VRE for research in the high-throughput phenotyping community, an evaluation approach will be performed in three piloting phases. This part describes the objectives and the process followed for the evaluation of the first piloting phase.

In the first pilot, the main objective was to gather expectations from potential users of the Food Security VRE. A workshop has been organized with 5 complementary representative persons of the phenomics community: a statistician, 2 phenotyping field and green-house platforms managers, a remote sensing researcher and an ecophysiologist. Initially, the concept of VRE and the Food Security VRE platform has been presented and, then an open discussion has followed regarding their first impressions of the Food Security and their requirements have been collected.

As described in Deliverable 7.3 - Community Centered Assessment Plan, the first pilot trial focuses on the assessment of main available features of the Food Security VRE, especially the data and process sharing functionalities.

The evaluation of the Food Security pilot is related to a global evaluation based on several indicators. The full list of evaluation indicators is described in the deliverable D7.3. The initial pilots trials will focus on the indicators are described in the table below.

Table 1: List of evaluation indicators for the Food Security VRE use cases

Indicator	Examples	Assessment method	Phase
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 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
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
FAIR-ness	How does the VRE help in making research data	Expert review	1, 2

	and algorithms FAIR (Findable, Accessible, Interoperable, Reusable)? Which are the advantage 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 of different types (textual, sql, RDF, images, location data, etc.)?		

3 EVALUATION INDICATORS

3.1 EASE OF USE

Assessing the ease of use of the Food Security VRE consists in answering the question: “How easy is it to use the VRE?” In other words: “Is the VRE user-friendly?”compared to existing tools, taking account of the new features interest.

3.2 LEARNING CURVE

The learning curve indicator is complementary to the ease of use indicator. It contributes to the evaluation of the time needed to learn how to use the features which are not easy to use right away because the user needs to be trained.

3.3 USEFULNESS

The usefulness indicator scores the functionalities the VRE provides. This indicator is used to check if every VRE feature is really relevant to the use case of high-throughput phenotyping. In order a feature to be accessible outside of the VRE, this indicator should also evaluate the feasibility of having this functionality inside the VRE.

3.4 OPENNESS

The openness indicator evaluates the contribution of features to openness which means: “Is it easy to add new data or new functionality?”

3.5 FAIR-NESS

The FAIR principles (Findability, Accessibility, Interoperability and Reusability) are key principles for open science on any VRE. This indicator should therefore evaluate how the VRE helps in making research data and algorithms FAIR and what the advantages and disadvantages are compared to current research environments and data management practices.

4 EVALUATION PROCEDURE

This chapter describes the detailed evaluation procedure that has been used for the first pilot evaluation. The evaluation was performed in 2 steps. First an informal evaluation has been made during a workshop where the VRE was presented and the participants' first impressions were collected. Then 3 new users were invited to test the VRE by following instructions and to answer to a survey based on the described indicators. This part describes the user scenario followed for this evaluation and the method used to assess each indicator.

4.1 FIRST GLOBAL EVALUATION

A workshop has been set up with 5 complementary representative persons of the phenotyping community (statistician, phenotyping platforms managers, remote sensing researcher & ecophysiologist).

Initially, the AGINFRA PLUS project and the concept of VRE were introduced. Then an experimented user of a VRE presented the tuna Atlas VRE. This is a VRE that has also been deployed in the D4science platform for the BlueBridge project. This VRE provides services to discover the available datasets from various Regional Fisheries Management Organizations. This presentation helped the other participants to better understand the potential of a VRE. Finally, the Food Security VRE was presented and the participants gave their first opinion and expectations of this VRE.

This a non-exhaustive list of the questions asked to the participants:

- Do you think this VRE could be useful for your work?
- What features are you really interested in? For what purpose?
- Do you think some features are missing?

4.2 NEW USER EVALUATION

This evaluation involves asking a new user to test several VRE features. The concept of VRE and the Food Security VRE had been presented to the user during a previous workshop. A document describing the steps to be followed is provided to the user. The steps are:

- Share and collaborate with other members (message posting, messaging system)
- Share datasets with other members (shared workspace)
- Access to different data sources (ReFindit, dataminer algorithm GetPlantHeight_FromPhenomeAPI)
- Developing analytics scripts and share them as black boxes (Rstudio, Jupyter, SAI)

Each step is not very detailed on purpose in order to see if the user can easily find how to use the features.

The user is asked to evaluate the features on a scale of 1 to 5 based on the 5 selected indicators (ease of use, learning curve, usefulness, openness, FAIR-ness) and to fill the table below:

Table 2: Notation table provided to the testers

Feature type	Features	Ease of use	Learning curve	Usefulness	Openness	FAIR-ness
Collaboration features	Messages publication					
	Messaging system					
	Shared workspace					
Data access	Discovery tool					
	Data access with dataminer algorithm					
Data visualization	Create and view a chart					
Data analysis	Developing environments					
	SAI (import scripts to share them as black box)					

To evaluate each feature, the user has to answer to these questions:

- Ease of use - How easy to use is this feature?
- Learning curve - For features which are not easy to use, how much time do you think you need to learn how to use it?
- Usefulness - Is this feature useful for my work?
- Openness - Does this feature contribute to openness (add data, new functionalities, share workflow)?
- FAIR-ness - Does this feature help to make research data and algorithms FAIRer?

At the end, the evaluator also has to answer to open questions. These questions should help us to understand and sometimes temper the indicators scores. The questions are listed below.

- Which features do you find the most useful or even necessary?
- Which features miss? What important features should be deployed in the VRE?
- Do you think a VRE could be a good environment for your daily work?
- Do you think phenotyping researchers are ready to use a VRE?

5 EVALUATION REPORT

5.1 FIRST GLOBAL EVALUATION REPORT

This part reports the workshop participants' feedbacks.

Isabelle Sanchez (Statistician):

She finds the collaborative functionalities very useful.
Having Rstudio deployed inside the VRE is something really important to her. She can have a R environment with all the necessary libraries and access to it from any machine. This is also very convenient to give training in R.
She expressed some reserves on the groups organization because the phenotyping community is hierarchical. Some issues could concern only one kind of platforms for example.

Romain Chapuis (Phenotyping platform manager):

According to him, a VRE could be a good tool to share on measurements protocols, problems with sensors, etc. He raised the issue of data ownership.

Philippe Burger (Phenotyping platform manager):

He finds the collaborative functionalities very important.

Frédéric Barret (Remote sensing researcher):

According to him, a VRE is a good way to share information. For example, if they have problems with their phenotyping machines they could share the way they solve it with others.
He could get a lot of data from other platforms in order, for example, to be able to do deep learning

Pierre-Etienne Alary (Ecophysiologist, Emphasis project partner):

He thinks that a VRE could be a good tool to collaborate inside the Emphasis project. The collaborative features could be very useful for this community.

5.2 NEW USER EVALUATION REPORT

Two users did this evaluation. One of them had attended the VRE workshop. At 5.2 is described what their evaluations revealed.

Initially, the table below presents the mean of each mark given by the 2 users.

Table 3: Mean of each mark given by the 2 users who did the evaluation

Feature type	Features	Ease of use	Learning curve	Usefulness	Openness	FAIR-ness
Collaboration features	Messages publication	5	5	4.5	4	2.5
	Messaging	5	5	4.5	2	1

	system					
	Shared workspace	5	5	5	4	3
Data access	Discovery tool	4.5	5	4	3	2
	Data access with dataminer algorithm	3.5	4	3.5	4.5	4
Data visualization*	Create and view a chart (4)					
Data analysis	Developing environments	3	3.5	3.5	3.5	2.5
	SAI (import scripts to share them as black box)	2	2.5	4.5	4	3

*The data visualization could only be tested by one of the two testers.

The collaboration features have proven to be very easy to use (intuitive) and very useful, especially the message posting feature which enable the user to easily inform his colleague or to be easily aware of everything shared on the platform.

The discovery tool ReFindit is easy to be used but needs to be enriched with other data sources with more data related to phenotyping. The algorithm enabling to get data from the web service and that is used in the phenoArch platform, is really useful but it is not configurable enough. For example, if the user only needs one genotype data, it could be very useful to get data from other platforms via web services.

The visualization tool works fine and is very intuitive but it’s not convenient to download the results file from the Dataminer to upload it inside the visualization tool. It would be easier for the user to visualize directly the file from the Dataminer outputs.

Rstudio and Jupyter are tools that researchers already use so they are used to them. The main advantage they recognize of having these tools inside the VRE is to be able to work on the same session from any machine. They can easily pause their work and get back to it no matter where they are, using another machine. The issue they raised was the fact that they couldn’t access to their workspace in order to open their R script directly inside Rstudio.

The Statistical Algorithm Importer is not so easy to use. It can be sometimes difficult to import a script, and the user may need support to do it. The user can be tempted to share directly his script and not import it so that other users to be able to directly run it. Nevertheless, importing the script will allow users with no skills in R or Python to run scripts. More over the user has the possibility to keep its script private and not visible to other users but he can give the opportunity to others to run it on their own data as a black box.

5.3 CONCLUSIONS AND FOLLOW-UP ACTIONS

As a result of this first pilot assessment, it can be stated that the Food Security VRE provides several useful functionalities for the phenotyping community. It is a tool with lots of potentials. Indeed, researchers from this community seem interested in using a VRE, especially the collaboration and sharing features. The next step will be to have more researchers registered on the VRE and using it. In order to do that, we will first take into account the first feedbacks we got from the community in order to improve available features and add new ones. Then we will promote the use of the Food Security VRE through the Emphasis-prep project.

ANNEX 1 – EVALUATION SCENARIO

I. Objectives

A VRE (Virtual Research Environment) is a collaborative working environment for a research community. The aim of this exercise is to assess the effectiveness of using a VRE for research in high-throughput phenotyping. This evaluation will be made in 3 phases. This is the first one.

The first evaluation of the VRE is based on these 5 indicators:

- 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?
- Learning curve: How much time is needed to learn new concepts etc. before the VRE can be used?
- 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 ofa visual component for the design of workflows?
- Openness: How easy is it to add new data and functionality to the VRE? How easy is it to share workflows, components, and data?
- FAIR-ness: How does the VRE help in making research data and algorithms FAIR (Findable, Accessible, Interoperable, Reusable). Which are the 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.)?

II. User scenario

Connect to https://aginfra.d4science.org/group/foodsecurity with your login and password (or sign in if it’s not already the case). Follow the instructions below.

1. Communication between members

a. Publish a message for other members in « share updates ». You should see this message in the « news feed » section.

b. Go to the messaging system  (in the top left corner) and send a mail to one member of the VRE (Alice Boizet).

2. Shared Workspace

a. Go to the workspace  (in the top left corner) and import a file inside your personal workspace and upload a file inside the VRE workspace.

b. Download a file from the VRE workspace.

3. Data Access

a. Go to Discovery Tool / ReFindit: test the research tool by entering free text or DOI (the data sources are written below the input field. INRA dataverse should be soon part of the data sources)

b. Dataminer algorithm to get data from phenomeAPI: Go to Analytics / Dataminer. Execute the algorithm “Get_plant_height_from_phenoarch” (in Data extraction category). You should get a csv file with plant heights data (this data come from the ZA17 experiment of the phenoArch platform in Montpellier)

4. Data visualization

Go to Data visualization/Create graphs. Click on Create. Import a csv file with data to visualize. Fill the required field and save.
Go to Data visualization/ View graphs and select your chart to display it.

5. Data Analysis

a. Developing analytics scripts (R or python):

Go to Rstudio or Jupyter and write or copy and paste a script inside the tool and run the script. If your script requires a library which is not in this list:
https://wiki.gcube-system.org/gcube/Pre_Installed_Packages , you can contact a manager of the VRE to install the library.

b. Share a script as a black box with the Statistical Algorithms Importer (SAI):

Import your script inside Dataminer: Go to Analytics/Import a new method. You can click on « help » button to go to the user documentation of this tool.

ANNEX 2 – FILLED EVALUATION SHEETS

Tester n°1. This tester didn't attend the VRE workshop.

Table 4: Results of the tester that didn't attend the VRE workshop

Feature type	Features	Ease of use	Learning curve	Usefulness	Openness	FAIR-ness
Collaboration features	Messages publication (1.a)	5	5	5	4	3
	Messaging system (1.b)	5	5	5	1	1
	Shared Workspace (2)	5	5	5	4	4
Data access	Discovery tool (3.a)	5	5	5	5	2
	Data access with Dataminer algorithm (3.b)	3	3	2	4	4
Data analysis	Developing environments (4.a)	2	2	4	3	3
	SAI (4.b)	2	2	4	4	3

Open questions:

- *Which features do you find the most useful or even necessary?*

Data Miner appears to be good tool (provided that I learn how to use it) allowing to store, analyse and share data and analysis pipelines.

- *Which features miss? What important features should be deployed in the VRE?*

I don't think there is something lacking for the moment.

- *Do you think a VRE could be a good environment for your daily work?*

Not for my daily work, but seems a nice tool for collaborative projects. This may avoid using the number of existing tools (google drive and docs, mails, repositories, etc…) and centralise in a unique and versatile tool.

- *Do you think phenotyping researchers are ready to use a VRE?*

Yes, they are smart people.

- *Other remarks:*

The phenoarch algorithm didn't work because the library was not updated.
When I am in Rstudio, I don't have access to my VRE folders.

Tester n°2: this tester attended the VRE workshop.

Table 5: Results of the tester that attended the VRE workshop

Feature type	Features	Ease of use	Learning curve	Usefulness	Openness	FAIR-ness
Collaboration features	Messages publication (1.a)	5	5	5	4	3
	Messaging system (1.b)	5	5	5	1	1
	Shared Workspace (2)	5	5	5	4	4
Data access	Discovery tool (3.a)	5	5	5	5	2
	Data access with Dataminer algorithm (3.b)	3	3	2	4	4
Data visualization	Create and view a chart (4)	5	5	4	4	3
Data analysis	Developing environments (5.a)	2	2	4	3	3
	SAI (5.b)	2	2	4	4	3

Open questions:

- Which features do you find the most useful or even necessary?

Rstudio and the collaboration features

- Which features miss? What important features should be deployed in the VRE?

Rshiny, more resources in data discovery

- Do you think a VRE could be a good environment for your daily work?

Yes, as an additional working environment, but not as a main environment.

- Do you think phenotyping researchers are ready to use a VRE?

Yes, some of them to some extent. Maybe mostly to:

- Discuss with other researchers
- Share scripts and visualize their results directly (better than email)
- Conduct surveys