



**AGENT-BASED
SUPPORT TOOL FOR
THE DEVELOPMENT
OF AGRICULTURE POLICIES**

D4.1 AGRICORE requirements and project management platform



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Lead Beneficiary	Ayesa Advanced Technologies
Authors	Alberto Rojas Fernández, Emiliano Mesa Arenas, Carlos Leyva
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Executive Summary

This deliverable presents the methodology to be used along the lifespan of the project AGRICORE in order to characterize, monitor and update all the requirements needed for the correct platform usage thanks to the inter connection of the different modules presented in the architecture.

This document starts providing a general overview of the AGRICORE project, describing the proposed architecture, operating environment and the use cases to be used as demonstrators. A methodology for the track of the requirements is declared and then requirements are defined for each of the existing modules in the platform. As part of this methodology usage, requirements have been included in the selected platform GitLab with the main aim to provide a clear understanding about the methodology proposed and how they can be mapped with the software tool that will be used along the project.

Thanks to this deliverable, the consortium will be able to follow a clear and easy methodology to declare future low-level requirements in each module, so this D4.1 can be considered an important step achieved for the development of the project with the expected quality. This deliverable is appointed as one of the major Milestones in the project, namely “MS4: AGRICORE suite requirements established” that can be considered achieved with the submission of this deliverable.

Abbreviations

Abbreviation	Full name
AAT	Ayesa Advanced Technologies
ABM	Agent-Based Model
AG	AGRICORE
API	Application Programming Interface
ARDIT	Agricultural Research Data Index Tool
ARPEGE NWP	Action de Recherche Petite Echelle Grande Echelle (<i>Numerical Weather Prediction</i>)
CAP	Common Agricultural Policy
CD	Continuous Delivery
CH, MH, SH, WH	Could Have, Must Have, Should Have, Won't Have (MoSCoW category)
CI	Continuous Integration
CPLEX	IBM optimization software package
DB	Database
DCAT	Data Catalogue
DCAT-AP	Data Catalogue Application Profile
DWH	Data Warehouse
EAB	External Advisory Board
ETL	Extraction Transformation and Loading
FR	Functional Requirement
GPU	Graphics Processing Unit
GUI	Graphical User Interface
GVA	Gross Value Added
HPC	High-Performance Computing
IAM	Impact Assessment Module
ICT	Information and Communications Technology
IDE	IDENER
IT	Information Technology
KPI	Key Performance Indicator
MH, CH, SH, WH	Must Have, Could Have, Should Have, Won't Have (MoSCoW category)
MIQCP	Mixed Integer Quadratically Constrained Program
MPP	Massive Parallel Programming
MoSCoW	Prioritization technique for managing requirements
NFR	Non Functional Requirement
NWP	Numerical Weather Prediction
OS	Operative System
SQL	Structured Query Language
WP	Work Package

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1. Introduction

The AGRICORE project proposes a novel tool for improving the current capacity to model policies dealing with agriculture by taking advantage of the latest progress in modelling approaches and Information and Communication Technologies (ICT). Specifically, the AGRICORE tool will be built as an Agent-Based Model (ABM) in which each farm will be modelled as an autonomous decision-making entity that individually assesses its context and makes decisions based on its current situation and expectations. This modelling approach will allow simulating the interaction between farms and their context (which will account for the natural environment, rural integration, ecosystem services, land use, input and output markets organisation and dynamics) at various geographic scales - from regional to global. The AGRICORE tool will fill certain gaps in the characteristics of existing modelling frameworks. In particular, it will be one of the few individual farms-based models going beyond the limitations imposed by other approaches centred on "average" farms. Moreover, the AGRICORE tool will mark a clear advancement on previous modelling efforts since it will develop a particular focus on the analyses of Pillar II Measures of the Common Agricultural Policy (CAP). Furthermore, the AGRICORE tool will benefit from innovative, advanced and open-sourceable ICT tools and procedures which will facilitate significantly the otherwise very resource-intensive and time-consuming nature of the model calibration phase, brought about by the complex nature of the modelling undertaken, which often characterises extant suites.

The goals of AGRICORE regarding software development includes the AGRICORE tool but also the EU Index Tool (now renamed to ARDIT) as well as all the modules that form these platforms. The AGRICORE project aims to be developed according to the high-level requirements defined in the project grant agreement. These high-level requirements frames the way how AGRICORE tool must be defined, developed and the expected goals. However, these requirements need to be registered and defined with more detail. Indeed, these high-level requirements will be the basis for the definition of broken-down individual software development requirements that will ensure meeting the user needs and the aimed security, interoperability, accessibility and performance. With this goal in mind, the present deliverable D4.1. (AGRICORE requirements and project management platform) provides the analysis and definition of the main requirements of the AGRICORE tool. Moreover, it details how those requirements are going to be further defined and how they are going to be evolved along the life cycle of the AGRICORE project. Accordingly, a clear methodology and approach for the requirements management is provided and represent one of the main key topics for this deliverable. It is important to remark that due to the methodology proposed in the project for the lifecycle management of requirements (and the monitoring of the project development), the requirements here provided are only the first iteration. This version will be continuously updated across the project.

1.1 Purpose

Requirements are one of the key points to address in a software project, in fact, the software requirement specifications are the pillars to drive the design, development and user experience and they allow to have a clear validation through testing. Having a clear definition of requirements is vital for the platform development in order to have further testing about what expectations are met in the AGRICORE tool and how they are reached.

This document has also been designed with the aim of being useful for, D6.6 "Software Quality Assurance measures for AGRICORE" to be submitted in M15 (November 2020). D6.6. will use this document as an input for its development, and their content will not be overlapped, so that this current deliverable is not covering anything related to SQA (Software Quality Assurance).

As described in previous deliverables of the project (D1.1. Standardised Methodology and Set of Ontologies for the Characterisation of Data Sources), the AGRICORE tool is a composition of multiple modules and services which undertake a specific function within the project. When AGRICORE tool is reference along the present deliverable, the definition contains all the modules and services which it is composed of. These modules are enumerated next below:

- D1 ARDIT (Agricultural Research Data Index Tool, previously referred as European datasource index tool). The tool allows users to search for different sources of publicly available data on the Web, categorised by the methodology implemented according the ontology AGRICORE DCAT-AP 2.0 extension.
- D2 DWH: Data Warehouse tool suitable for supporting the analyses contemplated within the AGRICORE project.
- D3 Data extraction Module: Module that extract all the data of interest from multiple datasets considered in the project. Data extraction encompasses the capabilities for accessing different datasets, selection the necessary data and formatting it for further processing.
- D4 Data fusion module: Combine the individualised data with the probability distributions of the variables to generate the joint probability distributions.
- D5 Synthetic populations generator: Module aimed to obtain realistic synthetic population making use of the Synthetic Reconstruction method.
- D6 ABM simulation engine: Instantiate agents for each farmer generated, evaluating its situation and making decision based on its preferences.
- D7 External interface module: Gateway for the interoperability between the modules to the ABM simulation engine.
- D8 Model interaction modules: Modules that interact with the model generation modules and the external interface module.
- D9 Biophysical model connection module: Provide a biophysical model to the AGRICORE tool.
- D10 Impact assessment module: Provides different modules used to evaluate the KIP's (Key Performance Indicators) related to specific topics (e.g. Environmental / Climate KPI's).
- D11 Policy environment module: Define different policies and translate them into an input for the simulation engine.
- D12 Agricore interface module: Centralise all the interactions of the user with the AGRICORE tool, allowing to see the results of the simulations defined and performed along the simulation process.

This first WP4 deliverable, "Usability Design and Visualisation of Large Data", aims to bring together all the functional and non-functional requirements of AGRICORE tool, to define all the needs of the end user, so this document provides a double objective.

- First, an analysis of the requirements for the development of the AGRICORE platform.
- Second, declaring the methodology to address a continuous monitoring of the technical developments from the point of view of the usability.

This deliverable is important at this stage of the project as it establish how the requirements are going to be managed along the whole lifespan of the project and because a first high-level of definition of each module requirements is provided using this declared methodology. This D4.1 document sets how the consortium and other involved actors can interact in order to ensure a proper requirements life cycle management.

1.2 Document conventions

At this stage of the project, a high-level description of requirements has been defined, so those gathered in this document are not totally closed. During the execution of the project, the different level of definition for the listed general requirements will be included in order to be monitored, so that this D4.1 can be considered a live document that will end up with the submission of D4.2 where the final requirements will be declared.

1.3 Intended audience

The D4.1 AGRICORE Requirements Specification document is primarily intended for all the consortium to have a clear view on the high-level requirements defined as clear structure to work on the detailed definition throughout the lifespan of the project.

The European Commission is also in the scope of the intended audience in order to report on the progress of the AGRICORE tool and meet the project's milestones.

Users, testers, and other stakeholders interested in this project (Domain experts) can use this document to learn about the methodology used for the standardisation of the defined requirements, as well as gain a better understanding of the AGRICORE tool and how requirements are covered in the project.

1.4 Additional information: security and confidentiality rules

Datasources are one of the main key factors of the AGRICORE project, which are used as a basis for working on the rest of the modules. Most of them are going to be gathered by public accessible sites and/or public sources. Moreover and, in any case, the data used in the project will be in general already anonymised, and no personal data are managed in those datasets. In case that further needs arise to gather other data, the project AGRICORE will ensure that any data will be anonymised and there is no track of personal data included in the platform.

2. AGRICORE Overall Description

This section describes a quick overview about the uses cases proposed and described in the Grant Agreement, as well as the enumeration of the main features offered by the AGRICORE tool to achieve the final solution. In order to clarify the technical scope, assumptions and constraints are defined.

2.1 Operating Environment

The AGRICORE platform is made up of multiple modules and services that interact among them using standard communication protocols. The combination of all of them gives rise to a single platform equipped with the main functionalities and features described in the present document.

The AGRICORE platform is configured to cover all the needs of the project. The three use cases of the project use the same platform, and there will not be any difference between the tool used. The only difference between the use cases defined are the data sources used and the Key Performance Indicators (KPIs) shown. These differences are the customisation sets available for users. Moreover, the planned platform goes beyond the execution of the three planned use cases and aims to become a mature platform that can be used for any use case at EU or national/regional level.

Figure 1 shows the general schema about the platform architecture in the current version:

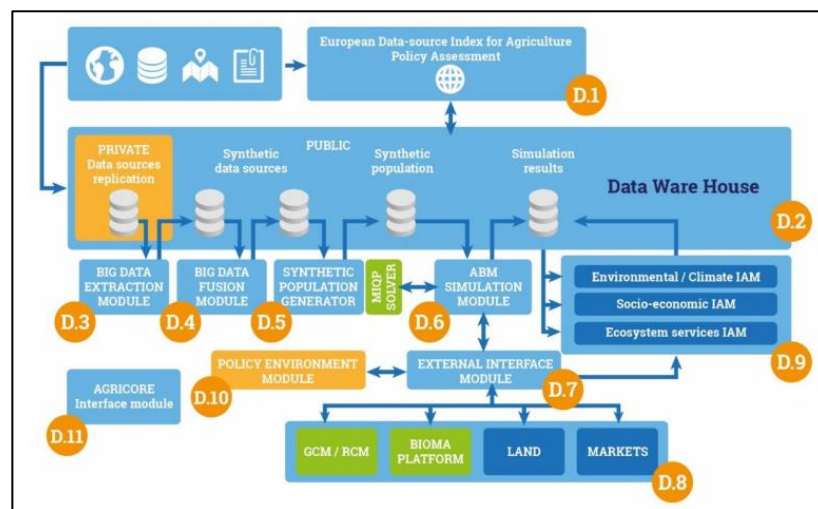


Figure 1 AGRICORE highly modular IT architecture

D1 in the figure represents the EU Index Tool, now renamed to ARDIT (Agricultural Research Data Index Tool). This autonomous element of the platform represents a single point where to map and characterise the different useful datasources for performing agricultural research. In the initial version of the project, this element was completely autonomous but in the current architecture, it already provides some connectivity to the D2 DWH (by the synchronisation of local and global indexes and by the inclusion of dedicated ETL scripts). The data warehouse represents the central data storage of the proposed system. This element represents a simple to deploy system that allows to storage different databases on it. Accordingly, it is used to store both the original data sources which have been fed into it as well as the processed information. The DWH also provides fast querying capabilities so D3 (Data Extraction Module), D4 Data Fusion Module and D5 Synthetic Population Generator can connect to it to produce the

synthetic populations required for the execution of the use cases. From that point, the ABM simulation module (D6) takes care of the communication with the DWH, serving as central point for gathering information for the rest of the modules that are used for the ABM simulation. Including the Model interaction module (D8) (which embeds the communication with land and market modules), the Biophysical models connection module (D9) and the Policy environment module (D10). Finally, the Impact assessment modules (D11) and the AGRICORE interface (D12) are directly connected to the DWH to gather simulation results (D11) for further processing the information to derive interesting KPI and to present them to the user.

Next sections cover a general description of the use cases with their main relevant requirements and data to take into account for the customisation of the use cases dashboards. These requirements must cover the assessment indicators enumerated below but, at the current state of project maturity, the targets defined for each indicator (expected threshold values) and the recollection periods for each indicator have not been defined yet.

2.1.1 Use case 1: Andalusia

In the use case 1, the AGRICORE tool will be tested for the area of Andalusia (NUTS 2 code ES69) for policy instrument related to environmental impacts. Andalusia is one of the most relevant agricultural areas in Spain and also in Europe, which is the fourth largest region in the EU-28. The AGRICORE tool will analyse the M11 measure (Ecologic agriculture) influence on Andalusia's olive sector, focusing on its environmental and climate impacts. The ex-post (after the event) analysis will be done for the period In the use case 1, the AGRICORE tool will be tested for the area of Andalusia (NUTS 2 code ES69) for policy instrument related to environmental impacts. Andalusia is one of the most relevant agricultural areas in Spain and also in Europe, which is the fourth largest region in the EU-28. The AGRICORE tool will analyse the M11 measure (Ecologic agriculture) influence on Andalusia's olive sector, focusing on its environmental and climate impacts. The ex-post (after the event) analysis will be done for the period 2014 to 2017 and the ex-ante (before the event) analysis will be done for the period 2018-2020. The biophysical models to be used will include a dynamic growth model for the olive tree aimed to the calculation of production indicators and to the quantification of the related environmental and ecosystem service impacts. The biophysical models to be used will include a dynamic growth model for the olive tree aimed to the calculation of production indicators and to the quantification of the related environmental and ecosystem service impacts.

The final impact assessment indicators are enumerated below among other socio-economic aspects:

- Environmental and climate impacts of farming:
 - Land conversion and habitat loss.
 - Wasteful water consumption.
 - Soil erosion and degradation.
 - Pollution.
 - Genetic erosion.
 - Climate change.
- Socio-economic aspects:
 - Viability.
 - GVA (Gross Value Added) of agriculture and related activities.

2.1.2 Use case 2: Poland

In the second use case, the tool will be tested for Poland (covering six NUTS level 1 Regions PL1-PL6) for analysing the M10.1 measure (Agri-environment-climate commitments), especially focusing on the rise of ecosystem services and on the environmental and climate impacts. The ex-post analysis will be done for the period 2014 to 2018 and the ex-ante impact analysis will be done for the period 2019-2020. Biophysical models including crop yields models based on the precipitation and temperature data, rainfall distribution models and pedotransfer functions will be used for properly calculating the impact of the measure as well as for enhancing the accuracy of the Agent-based model (ABM) simulations.

The expected impact assessment indicators are listed below:

- Ecosystem services:
 - Provisioning: Food provision, water provision, raw materials.
 - Regulation: Regulation of water
 - Supporting: Biological control, production quality.
- Environmental and climate impacts of farming:
 - Soil erosion and degradation.
 - Pollution.
 - Genetic erosion.

2.1.3 Use case 3: Greece

In the use case 3, the tool will be tested for Greece (level 1 NUTS areas, EL3, EL4, EL5 and L6) for analysing M6.1 measure (Start-up aid for young farmers) focusing on the socio-economic aspects. Agriculture in Greece is one of the main employers, contrasting with the rest of Europe, having much smaller farms on average. The ex-post analysis will be done for the period 2014-2017 and the ex-ante impact analysis will be done for the period 2018-2020. Biophysical models (generic and crop-specific) will be used to calculate the productivity and the yield of the exploitations on different climate scenarios.

The final impact assessment indicators are the following:

- Socio-economic aspects of the integration of agriculture in rural society:
 - Rural employment, especially considering gender aspects.
 - Viability of local micro, small and medium-sized enterprises within the agricultural value chain.
 - Young people attraction to the rural areas.
 - GVA (Gross Value Added) of agriculture and related activities.

2.2 User environment

In the aspect of the non-experienced user, there are two main tools which are ARDIT and AGRICORE Interface to interact with, which will be developed during the AGRICORE project. Both of them are provided in a web-based solution to increase the accessibility of the platform for different environments, as well as desktop application but based on web technologies.

ARDIT is a data source index tool for the support of agricultural policy assessment, which was previously named in the project as European data sources index module (Task 1.8). The platform

allows users to search for different sources of publicly available data on the Web, categorised by the methodology implemented according the ontology AGRICORE DCAT-AP 2.0 extension. AGRICORE interface centralise all the interactions of the user with the AGRICORE tool, allowing to see the results of the simulations defined and performed along the simulation process.

Referring to dataset searching operations, ARDIT system contributes in this plan, allowing:

- Advanced search services using natural language or advanced categorisation tools searching by specific parameters such as area, topic or variables, among other.
- Propose new open source datasets to be indexed by the tool.
- Deploy the tool in local to use the ARDIT tool for own private datasets.
- Launch an ETL (Extraction, Transformation and Loading) process over a selected dataset in order to be stored in the local and private DWH

Regarding the AGRICORE interface module:

- It centralises the interaction of the users with the AGRICORE suite, so the development of future modifications, extensions or even alternative interfaces is facilitated.
- Select and visualise geo-referenced information resulting from the AGRICORE analysis execution.
- Data representation via maps, charts and plots.
- Interact with the semantic service to simplify the user interaction with the system.

2.3 Design and Implementation Constraints

The design and implementation processes involved to achieve the defined and expected results take into account a set of different constraints provided and defined during the start of the project.

- The AGRICORE tool must be open source. This policy will allow to all the different researches and institutions to use the tools implemented during the AGRICORE project, as well as to provide further improvements using the methodology described in this document.
- The source management, requirements and task definition will be implemented and monitored using GitLab in its Gold version. Using this tool will allow to increase the traceability and maintenance of the AGRICORE tool thanks to the unification of all the necessary tools within the same management platform.
- The AGRICORE architecture must be highly modular. Any researcher and/or developer could be able to integrate a custom module or a new feature following the guidelines defined among the project (by means of the use of the standard communication protocol, data types and formats).
- The modular architecture must be able to be deployed on a local infrastructure and in the cloud, giving the possibility of using private and customised implementations of modules to be integrated into the AGRICORE suite.
- All the data sources indexed and registered in ARDIT must be categorised with a validated ontology AGRICORE DCAT-AP 2.0 extension.

2.4 Assumptions and dependencies

In order to meet the AGRICORE platform requirements to provide the solutions for the use cases defined in the project, several assumptions and dependencies are defined in the next sections to frame the working coverage area, as well as the dependencies required for the project development.

2.4.1 Assumptions

- English language as official in the project. Multi language tool will be deployed in the future.
- The datasources requested by the use cases to generate the different models needed must be available during the life cycle of the project.
- The datasources are independent, so they are not interdependencies among them and joint operations are not going to be necessary during the ETL process.
- The size of the datasources will not be a limitation for the project to be scalable.
- All datasources used along the project are anonymised.
- New datasources needed to extend the project needs are object of being anonymised before being included in the project
- All information recorded and processed in the AGRICORE DWH (Data Warehouse) module will be anonymised thus ensuring that in no situation the processed information can be related to any particular person or holding. This way, the project partners commit themselves to work only with completely anonymised information.
- The development of all the modules forming the AGRICORE solution will be adapted to the stakeholders needs identified during the project. However, the changes done in the initial planned development should not go against the planned developments but rather extend or further detail them.

2.4.2 Dependencies

- The datasources requested by the use cases to generate the different models needed must be available during the life cycle of the project.
- The datasources defined must be characterised within the work reported in deliverables D1.3, D1.4, D1.5, D1.6 due on M29 and following the methodology established in D1.1.
- The different ontologies defined during the project should be available for consultation when required.

3. Methodology

Once defined a first overview of the AGRICORE architecture and its three use cases where the project will be deployed, this section covers the methodology for the requirements to be tracked along the project.

The main purpose with the definition of a software requirements methodology is to ensure that all the requirements are defined and evolved using a simple, predefined and homogeneous solution, making use of agile processes and techniques to ensure a quality and traceability of requirements through the solution of the AGRICORE tool developed. The main objective is having a granularity of the requirements and gather them in a clear structure that helps on the life cycle management. This methodology defined is considered an ongoing process that will be extended if the project requires it, depending on the needs that may arise.

Although the definition of a methodology at a theoretical level should not be associated with a specific tool, the task of selecting an IT tool for its implementation is an important one, since it will accompany the project on a daily basis. During this analysis, different options were possible to be addressed at this stage of the project. The in-house knowledge of AAT about different project management tools which supports features such as requirements definition, recommends using JIRA as the main tool to go through the requirements life cycle as it was declared in the Grant Agreement. JIRA is a project management software tool focused on TI organisations that covers all the life cycles of a software project. According to the AGRICORE needs, JIRA facilitates the requirements and tasks definition and their traceability with the technical development associated with each of them, accompanied by a user-friendly interface. One of the great features that JIRA has is the integration with external services such as source code management tools or automatic testing services and scheduled deployments ^[1].

Nevertheless, since JIRA is not an open source platform and license means an extra expense in the project, AAT (Ayesa Advanced Technologies) along with IDENER made a study about the potential strengths of JIRA versus the current needs of the AGRICORE project to be used as requirements monitoring and project management tool. The main conclusion was that not all the JIRA functionalities were going to be useful for the project because just a limited number of them would be valuable to track different fields in the requirement life cycle. Derived from this analysis, we opted for using GitLab with the Gold package that is granted for free by Gitlab as the AGRICORE project is an open source tool. The GitLab Gold package can cover all the necessities of the project and ensure at the same time that the project meet the best value for money in every decision made. GitLab is an open core company which develops software for the software development lifecycle. It provides an open source end-to-end software development platform with built-in version control, issue tracking, code review, among other. GitLab has different plans according to the team and/or organisation that is going to use it. Because of AGRICORE is an open source project, GitLab provides free plans for this kind of projects, allowing to use all the features that they has in its platform ^[2].

In this deliverable, requirements definition methodology was used in a high-level scope, but later in the project, low level detailed requirements will be defined using the same methodology.

- **High-level requirements definition:** The high-level requirements definition are based on the information provided in the Grant Agreement nº816078 for the project AGRICORE. This information comes from the analysis of the project objectives, the descriptions of all the different WP, and the whole architecture proposed for all the AGRICORE set of tools. They have been analysed and defined by partners AAT and IDENER with the contribution of the rest of the consortium.
- **Low-level requirements definition:** The next step will be to populate the previous high-level requirements with detailed features along the project development with low level details to increase the granularity of the set of elements which the AGRICORE project is

composed. The low level requirements will be defined by all the different partners and stakeholders participating in the AGRICORE project.

- **Technical tasks definition:** Each requirement must be granulated into different technical tasks to meet the objective of the requirement.
- **Requirement definition validation:** Once a low-level requirement is defined, IDENER/AAT has to verify that the requirement has been defined according to the methodology. AAT or IDENER can either accept the requirement or reject it by providing an answer as to why the requirement has not been validated.

During the life cycle of the AGRICORE tool requirements, there are several actors involved during the process:

- **Requirement creators:** Consortium, coordinator, AAT and IDENER as main project developers, Stakeholders and External Advisory Board (EAB). Derived from the open source nature of the AGRICORE project, anyone could propose a new functionality for the AGRICORE tool in the future, but only the requirement creators can define a new requirement.
- **Approvers:** Coordinator IDENER.

To embrace this methodology in the project, GitLab software platform will be used for the process of requirements analysis, definition and continuous monitoring of technical process integrating all the processes in the same platform. Making use of the epics and issues definition features, the requirements have been defined and associated to the AGRICORE GitLab public group. According to GitLab, epic is a high-level technical task that could include other epics or low-level technical tasks, which are called issues.

- **High-level requirements:** are registered using **epics**. As it was defined previously, epics allows to define high-level technical tasks that could include a group of epics or issues. With these epics, it would be possible to get know about the different issues created in distinct projects of the AGRICORE group, track all the related activities and discuss about them.
- **Low-level requirements:** The low-level requirements are defined as **epics** but they should be a child of another epic. This epic that is not a high-level requirement is called **child epic**. This methodology allows to know the relationship between the requirements of a same theme. A low-level requirement can only have one parent.
- **Technical tasks:** When a requirement has been analysed, defined and registered, technical tasks could be registered and associated to a epic by using the concept of "**issues**"[3].

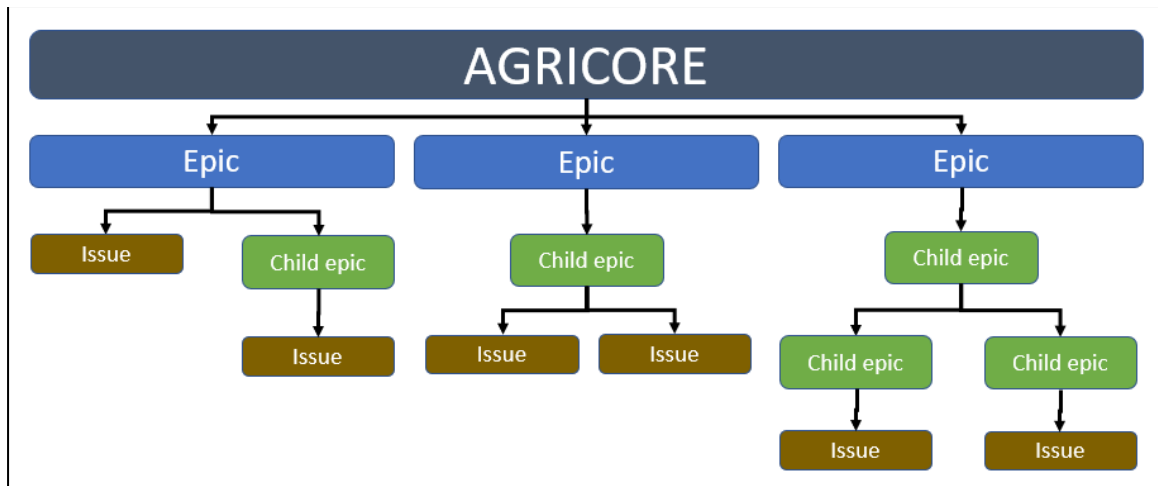


Figure 2 Epic - sub epic - issue hierarchy

Labels are a GitLab concept that consists of a custom coloured text tag that allows to add semantics to an epic or an issue^[4]. An epic can be tagged with labels to characterise an AGRICORE requirement. This leads to the possibility of filtering requirements by a label such as type or priority. Another feature about the labels are the scoped labels. A scoped label is a label of the form `key::value` that offers a disjunction operation so, an epic cannot have two scoped labels with the same *key*. This option automatise some rules that a requirement must have. As an example, a requirement could be tagged as a functional requirement (FR) or non functional requirement (NFR), so an epic could have a label `type::FR` or `type::NFR`, but not both of them at the same time. Next figure shows how a scoped label is shown in GitLab

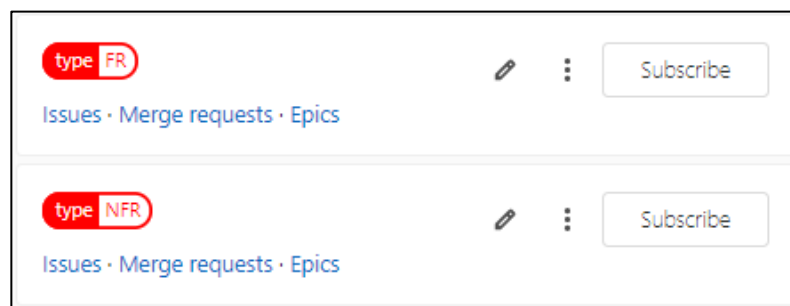


Figure 3 GitLab scoped label example

Epics have a custom free text description field where other specific values of the requirement could be registered using a table.

All the requirements must contain a number of characteristics that are involved in the analysis, development and evaluation processes, which are defined below:

- Code:** Unique requirement identifier which describe the module and the type of the requirement.
 The pattern code for all requirements follows the structure: `AG.Dx.<TR>.<ID>.<hierarchy>`, for example `AG.D0.FR.001-1-1`, where:
 - `AG`: AGRICORE project.

- *Dx*: Dx module reference.
 - D0: Global requirement.
 - D1: ARDIT.
 - D2: DWH.
 - D3: Data extraction module.
 - D4: Data fusion module.
 - D5: Synthetic population generator.
 - D6: ABM simulation module.
 - D7: External interface module.
 - D8: Model interaction module.
 - D9: Biophysical models connection module.
 - D10: Impact assessment modules.
 - D11: Policy environment module.
 - D12: AGRICORE interface module.
- *TR*: Type of requirement.
 - FR: Functional requirement.
 - NFR: Non functional requirement.
- *001*: Incremental id.
 - 1-1: When a requirement is a child of another, an incremental id is used per each layer.
- **Title**: Descriptive title of the requirement.
- **Definition**: Full detailed description of the requirement.
- **Requester**: Partner which has presented the requirement.
- **Type**: Functional or non functional requirement.
- **Related modules**: Related modules identifiers. Although a requirement is associated to a specific module, a requirement could interact with several modules of the platform at the same time.
- **Release**: The version of the requirement defined. If a requirement changes its scope, the release version number must be modified.
- **Tested**: Test tracking status indicator.
 - *Yes*: The requirement has been tested successfully.
 - *No*: The requirement has not been tested yet.
- **Status**: This characteristic could have one of the following 5 values.
 - Draft.
 - Proposed.
 - Approved.
 - Rejected.

- Implemented.
- **Priority:** The MoSCoW method is a prioritization technique used in the management, business analysis, project management, and software development to reach a common understanding with stakeholders on the importance they place on the delivery of each requirement; it is also known as MoSCoW prioritization or MoSCoW analysis[5]. A requirement must have only one of the values that the MoSCoW method defined:
 - *Must have (MH):* These provide the Minimum Usable SubseT (MUST) of requirements which the project guarantees to deliver.
 - *Should have (SH):* Important requirement but not vital for delivery in the current delivery timebox. May be painful to leave out, but the solution is still viable.
 - *Could have (CH):* Desirable requirement but less important.
 - *Won't have (WH):* Requirements that have been agreed by stakeholders as the least-critical.

All the requirements defined and integrated in the GitLab platform will be included in Annex A .

3.1 Requirements Life Cycle

Once the methodology of using epics, sub-epics, and issues are defined along with all the characteristics of the requirements definition, this section describes how these characteristics are mapped with the Gitlab platform in an operative way through epics and issues. The next list enumerates the attributes of the requirements and how they are mapped in GitLab.

- **Code:** title field.
- **Title:** title field.
- **Definition:** description field.
- **Requester:** description table, requester row.
- **Release:** description table, release row.
- **Type:** scoped label (FR, NFR).
- **Related modules:** label (D0, D1, D2, D3, D4, D5, D6, D7, D8, D9, D10, D11, D12).
- **Tested:** scoped label (Yes, No).
- **Status:** scoped label (Draft, Proposed, Approved, Rejected, Implemented).
- **Priority:** scoped label (MH, SH, CH, WH).

Next figure shows an example about how an Epic is introduced in Gitlab where the application of the previous list has been taken into account.

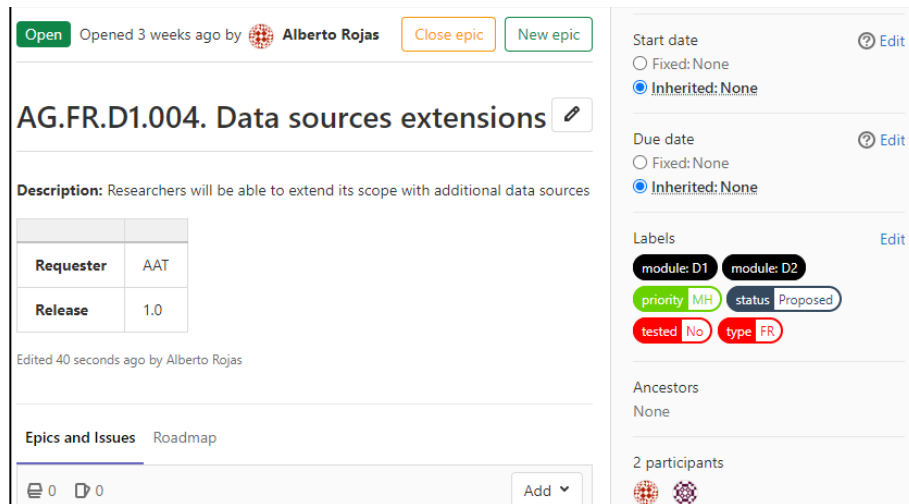


Figure 4 Requirement defined in GitLab

In this image a full requirement has been included following the guidelines provided above. The mapping between the image in a GITLAB requirement and its content is declared below:

- **Code:** Title of the epic (AG.FR.D1.004).
- **Title:** Title of the epic (Data sources extensions).
- **Definition:** Inside the body of the epic (Researchers will be able to extend its scope with additional data sources).
- **Requester:** In the description table(AAT).
- **Release:** In the description table (1.0).
- **Type:** FR (indicated in the code and with the red label type: FR).
- **Related modules:** black labels (module: D1, module: d2).
- **Tested:** Label (tested: No).
- **Status:** Label (status: Proposed).
- **Priority:** Label (priority: MH).

4. Requirements: Functional and Non functional

This section provides the AGRICORE tool requirements. It is aimed to know all the AGRICORE modules responsibilities and boundary functionality with other modules and systems.

4.1 Agricore Agents-based requirements

In this section, all the requirements are defined according to the advance of the project up to July 2020. Furthermore, and following the methodology here defined, in Annex A all the requirements introduced in GitLab software are depicted.

4.1.1 D0: General requirements

4.1.1.1 AG.D0.NFR.01. Open source

Definition: The AGRICORE tool must be open source and publicly available. This requirement does not rule out that some software component used is not. In this case, it must be justified the use of it.

4.1.1.2 AG.D0.NFR.02. Institutions can transparently update and improve the tool as needs arise

Definition: The AGRICORE tool should be available in a public repository for anyone who wants to update and improve any of the tools it consists of. The governance of the repositories will always be the partners involved in the AGRICORE consortium during and after the development of the project, led by the main coordinator of the project (IDENER).

4.1.1.3 AG.D0.NFR.03. Modularity of agents

Definition: The modules that are involved in the AGRICORE tool such as Land Market module or Biophysical module have to be implemented using the same communication interfaces, format and data structures.

4.1.1.3.1 AG.D0.NFR.03-1. Allow the substitution of the modules of the platform by other developed by other researcher

Definition: The main modules developed in the system (such as Land Market module, Biophysical modules, etc.) have to be developed following a defined communication pattern to ensure the complete modularisation of the modules that are involved in the system. The modules must have the property of potentially being replaced by another implementation, abiding by the output interface diagrams.

4.1.1.3.2 AG.D0.NFR.03-2. Reuse of the individual modules in other solutions

Definition: The main modules developed in the system (such as the Land Market module, Biophysical modules, etc.) have to be isolated from the AGRICORE platform to provide reuse in other ecosystems outside AGRICORE.

4.1.1.4 AG.D0.NFR.04. The architecture will be defined to allow making use of the high computing capabilities of the cloud infrastructure

Definition: The architecture defined must have the capabilities to externalise the execution of the high computing operations, using external mathematical modules or systems.

4.1.1.5 AG.D0.NFR.05. The architecture will be defined as Cloud-independent, allowing the use of cloud infrastructures both at public and private levels

Definition: The architecture have to be able of being executed in different cloud services, making use of operative system (OS) isolation technologies such as Docker. The development of different deployment scripts for a wide range of cloud providers is not a requirement.

4.1.1.6 AG.D0.NFR.06. Strong focus on data security

Definition: The AGRICORE suite will allow the definition of private and public sections.

4.1.1.7 AG.D0.NFR.07. Standardise the communication between the external models and the rest of the suite

Definition: The ontologies and communication interfaces between the modules will be specified to know the communication protocols, formats, data structure, schemas and data types.

4.1.2 D1: ARDIT

4.1.2.1 AG.D1.FR.01. Provide a publicly accessible index of agriculture data sources

Description: ARDIT must provide a publicly accessible index of data sources available for agriculture policy assessment.

4.1.2.2 AG.D1.FR.02. Available for all stakeholders

Description: The ARDIT platform must be publicly available for all stakeholders (from data analysts to policy makers and researchers).

4.1.2.3 AG.D1.FR.03. Store relevant information of the data sources

Description: ARDIT must allow the registration and modification of data sources according to the ontology (AGRICORE DCAT-AP 2.0 extension), as well as to be easily updated to adapt to the evolution of the ontology. Relevant data from the datasources such as:

- Fields.
- Spatial scope.
- Resolution.
- Aggregation level.
- Update frequency.
- Last update available.
- Privacy level of the data.
- Accessibility.

4.1.2.4 AG.D1.FR.04. Researchers will be able to extend its scope with additional data sources

Description: ARDIT must have a mechanism for extending the scope of the tool with the addition of further data sources to the tool by researchers. Researchers may add or suggest new data sources depending on the level of authorization they have.

4.1.2.5 AG.D1.FR.05. Semantic search will be allowed

Description: ARDIT allows semantic searches using a dedicated API to identify datasets and other similar ones. However, ARDIT does not allow finding data within a dataset.

For example, a search could be done using natural language such as: 'PH data from Italy between 2018 and 2019'.

Priority: SH

4.1.2.6 AG.D1.FR.06. Advanced search will be allowed

Description: ARDIT allows advanced search for experienced researches, using the GUI (Graphical User Interface) to select specific attributes and values to retrieve the datasets indexed in the tool.

4.1.2.7 AG.D1.FR.07. Local deployment capability

Description: ARDIT could provide a way to deploy the tool in a private environment, allowing the possibility to be synchronized with the ARDIT global tool to retrieve the new public datasets indexed.

Apart from these high-level requirements, ARDIT tool has more level of detail because it's in a more mature status. Task 1.8 is devoted to this development and following this methodology requirements have been included in GITLAB with lower detail in order to advance on its development and meet the expected deadlines.

4.1.3 D2: DWH

4.1.3.1 AG.D2.FR.001. Centralize the information exchange within the AGRICORE IT architecture

Description: The system should centralize all information exchange within all AGRICORE modules. DWH could be deployed in a cloud, in a local architecture or both.

4.1.3.2 AG.D2.FR.002. Use a combination of SQL and non-SQL databases massive parallel programming (MPP) technology and/or Hadoop/Spark

Description: The system must provide high computing technologies using a combination of SQL and non-SQL databases and/or Hadoop/Spark to execute high-demand operations.

4.1.3.3 AG.D2.FR.003. Provide high-performance analysis capabilities to the DWH

Description: DWH must provide technical capabilities to launch high-performance operations such as Spark. These operations could have different purposes such as data extraction, processing and generation, among other.

4.1.3.4 AG.D2.FR.004. Easy-to-manage access permissions

Description: DWH must provide an access permission using the permission mechanism provided by Hadoop.

4.1.3.5 AG.D2.FR.005. Separate critical/private information from information suited to be made public

Description: The DWH must be able to separate different information sections as private and public. The ETL developers should have administrator access to the system but not for ETL launchers.

4.1.3.6 AG.D2.FR.006. Support both private and public cloud infrastructure deployment

Description: The DWH system must be able to be deployed in public and private cloud architectures.

4.1.4 D3: Data extraction module

4.1.4.1 AG.D3.FR.001. Data of interest extraction

Description: The data extraction module has to be able to extract all the data of interest from the multiple datasets considered in the project. Not all the attributes might be necessary to build the synthetic individuals, but only the attributes of interest. Data extraction encompasses the

capabilities for accessing the various databases (DBs), selecting the necessary data and formatting it for further processing.

4.1.4.2 AG.D3.FR.002. Distribution curves generation

Description: The data extraction module must allow the generation of distribution curves of individual variables inside datasets involved in the case. The user case implemented should extract the distribution curves (both individual and joint) from all the datasets involved in the use case.

4.1.4.3 AG.D3.FR.003. Optimized data extraction operations

Description: The module must provide optimized data extraction operations in terms of computational efficiency and speed using the capabilities offered by Spark.

4.1.4.4 AG.D3.FR.004. Data output stored in DHW

Description: The module must provide its output storing the results in the DWH.

4.1.5 D4: Data fusion module

4.1.5.1 AG.D4.FR.001. Infer the underlying joint probability distribution by means of statistical inference methods

Description: The data fusion module must combine the individualized data with the probability distributions of the variables to generate the joint probability distributions for the main attributes describing the population of interest. The data fusion module includes the generation, from the extracted data, of any statistical parameter or statistical function, which can later be used both for population synthesis and for the comparison of synthetic population with the real population, by comparing its statistical measures.

The data fusion module should be composed by a statistical functions generator and a statistical parameters calculator sub modules.

4.1.5.2 AG.D4.FR.002. Data output stored in the DHW

Description: The data fusion module must provide its output storing the results in the DWH.

4.1.6 D5: Synthetic populations generator

4.1.6.1 AG.D5.FR.001. Synthetic Reconstruction method

Description: The system must be able to make the Synthetic Reconstruction method aimed to obtain realistic synthetic populations. The module creates successive empty individuals, and either sequentially or globally assign values to the attributes of interest considered.

4.1.6.2 AG.D5.FR.002. Match the distribution of the agents' population of interest taking account of the joint probability distributions

Description: The module has to compare the goodness-of-fit of the population generated. If the population result does not fit enough, the module should be able to modify the values of the attributes of the agents until the goodness of fit is acceptable.

4.1.6.3 AG.D5.FR.003. Receives input from the Data fusion module

Description: The synthetic population generator must receive input information from the Data fusion module, although the module could have simple and joint distribution curves pre-calculated and stored in the module

4.1.6.4 AG.D5.FR.004. Data output stored in the DHW

Description: The module must provide its output storing the results in the DWH.

4.1.7 D6: ABM simulation engine

4.1.7.1 AG.D6.FR.001. Simulate the evolution of the ABM population

Description: The ABM simulation engine must instantiate agents for each farmer generated in the Synthetic population generator. Each agent evaluates its situation and makes a decision based on its preferences, generating an output consisting of the evolution of each agent.

4.1.7.2 AG.D6.FR.01-1. Simulations are based on Synthetic population module data

Description: The ABM simulation engine must use the data provided by the Synthetic population generator.

4.1.7.3 AG.D6.FR.001-2. Agents will be instantiated according to the synthetic population already generated

Description: The ABM simulation engine must instantiate the agents according the data recovered

4.1.7.4 AG.D6.FR.001-3. Will be connected to a mathematical solver in order to perform the iterations needed to simulate the evolution of the agents

Description: The ABM simulation engine must be connected to a mathematical solver to perform the agent evaluation. Each agent evaluates its situation and makes a decision based on its preferences, generating an output consisting of the evolution of each agent.

4.1.7.5 AG.D6.FR.002. Manage the interactions required with the external modules

Description: The ABM simulation engine must manage the interaction required with the external simulation modules of the system.

4.1.7.5.1 AG.D6.FR.002-1. Interaction with the land module

Description: The ABM simulation engine must manage the interaction with the land module.

4.1.7.5.2 AG.D6.FR.002-2. Interaction with the markets module

Description: The ABM simulation engine must manage the interaction with the markets module.

4.1.7.5.3 AG.D6.FR.002-3. Interaction with the environment module

Description: The ABM simulation engine must manage the interaction with the environment module.

4.1.7.5.4 AG.D6.FR.002-4. Interactions with the biophysical module

Description: The ABM simulation engine must manage the interaction with the biophysical module.

4.1.7.6 AG.D6.FR.003. Include the farm ABM model

Description: The Agent model (the farm model) should be the unit that is simulated in the simulation engine.

4.1.7.7 AG.D6.NFR.001. Fully object-oriented implementation

Description: The ABM model must be implemented with the object oriented programming paradigm.

4.1.7.8 AG.D6.NFR.002. Allow a set of high performance computing features

Description: The ABM simulation engine must include some methods ensuring high-performance computing of the embedded optimization problems.

4.1.7.8.1 AG.D6.NFR.002-1. Exploitation of parallel processing and cloud computing environment capabilities

Description: ABM simulation engine must exploit the capabilities of parallel processing and cloud computing.

4.1.7.8.2 AG.D6.NFR.002-2. Evaluate the execution in GPU-based architectures

Description: Evaluation of the ABM simulation engine execution in GPU-based architectures.

Priority: Valuable

4.1.7.8.3 AG.D6.NFR.002-3. Use of latest releases of best rated off-the-shelf mathematical solvers

Description: Allow the use of latest releases of best rated off-the-shelf mathematical solvers such as IBM CPLEX MIQCP, GUROBI or open sources alternatives.

4.1.7.8.4 AG.D6.NFR.002-4. Implementation of warm-start techniques

Description: Allow the use of warm-start techniques implementation. Optimized calls to the solver taking advantage of tentative solutions already available from other similar agents.

4.1.8 D7: External Interface module

4.1.8.1 AG.D7.FR.001. Serve as a central point of link for the agent based simulation module with the set of external modules

Description: The external interface module should act as a gateway for the interoperability between the modules to the ABM simulation engine.

4.1.8.2 AG.D7.FR.002. Exploit the ontologies to be established within the project

Description: The external interface module must exploit the ontologies defined for its communication interfaces exposed to the other modules.

4.1.8.3 AG.D7.NFR.001. Facilitate the incorporation of additional external modules by other researchers

Description: The external interface module must meet the specifications in terms of information exchange and the exploitation of the ontologies to be established within the project to facilitate the incorporation of additional external modules by other researchers.

4.1.9 D8: Model interaction modules

4.1.9.1 AG.D8.FR.001. Interact with the simulation engine

Description: The Model interaction modules have to interact with the simulation engine through the external interface modules.

4.1.9.2 AG.D8.FR.002. Include the next modules

Description: The Model interaction modules must include the different modules enumerated below:

- Land Module: This module must include a land market that enables the interaction of the farmers by allowing them to place bid/ask orders according to the land market prices.
- Markets module: This module must simulate the dynamics of the production market prices and considering additional market feedbacks as production factors.

- Biophysical module: This module must be linked to BioMA (Biophysical Model Applications) platform unless a better alternative is identified and validated by the stakeholders (JRC, DG.AGRI) and accepted by the REA).
- ARPEGE module: This module must be linked to an ARPEGE (global numeric weather prediction) model data provider.

4.1.9.2.1 AG.D8.FR.002-1. Include the Land module

Description: The Land module must be provided by the Model Interaction modules.

4.1.9.2.1.1 AG.D8.FR.002-1-1. Definition of the land module resource transfer mechanism

Description: The Land module must provide a mechanism to transfer agricultural resources between the agents.

4.1.9.2.2 AG.D8.FR.002-2. Include the Markets module

Description: The Markets module must be provided by the Model interaction modules.

4.1.9.2.2.1 AG.D8.FR.002-2-1. Simulate dynamics of production market prices

Description: The Markets module must simulate the dynamics of the production market prices.

4.1.9.2.2.2 AG.D8.FR.002-2-2. Markets module should include additional market dynamics

Description: The Markets should include additional market dynamics such as manure, fodder and young animals.

4.1.9.2.3 AG.D8.FR.002-3. Include the Biophysical models connection module

Description: The Biophysical models connection module must be provided by the Model Interaction modules.

4.1.9.2.4 AG.D8.FR.002-4. Include the ARPEGE module

Description: The ARPEGE module must be provided by the Model Interaction modules.

4.1.9.2.4.1 AG.D8.FR.002-4-1. Provides variables from an NWP model

Description: The ARPEGE module must provide an specific number of variables provided by a NWP model. This could be achieved by providing a link to external data providers or from information stored in the DWH.

4.1.9.2.4.2 AG.D8.FR.002-4-2. Provides weather data to Biophysical module.

Description: The ARPEGE module must provide weather forecasts that can be used by the Biophysical module or by any other module that requires it.

4.1.10 D9: Biophysical models connection module

4.1.10.1 AG.D9.FR.001. Provides biophysical model to the AGRICORE tool

Description: The Biophysical models connection module must to provide a biophysical model to the AGRICORE tool.

4.1.10.2 AG.D9.FR.002. Include plant, weather, stress, soil and agriculture management

Description: The biophysical model must provide information about plant, weather, stress, soil and agriculture management.

4.1.10.3 AG.D9.FR.003. Make use of a weather model provider (ARPEGE)

Description: The Biophysical module should access to the ARPEGE weather provider (or any other) to establish the climatic conditions that are affected in the biophysical simulation model.

4.1.11 D10: Impact assessment module

4.1.11.1 AG.D10.FR.001. Include next modules

Description: The Impact assessment module must provide the modules enumerated below, which are used to evaluate the KPIs related to their specific topic:

- Environmental / Climate module
- Socio-economic IAM module
- Ecosystem services IAM module

4.1.11.1.1 AG.D10.FR.001-1. Include the Environmental / Climate module

Description: The Environmental/Climate module must be provided by the Impact assessment module.

4.1.11.1.1.1 AG.D10.FR.001-1-1. Compute the main KPIs related to the environmental and climatic impact assessment

Description: The Environmental/Climate module must compute the main KPIs related to the environmental and climatic impact assessment.

4.1.11.1.2 AG.D10.FR.001-2. Include the Socio-economic IAM module

Description: The Socio-economic IAM module must be provided by the Impact assessment module.

4.1.11.1.2.1 AG.D10.FR.001-2-1. Assess the relationship between policy incentives and KPIs related to the integration of agriculture in rural systems

Description: The Socio-economic IAM module must assess the relationship between policy incentives and KPIs related to the integration of agriculture in rural systems.

4.1.11.1.3 AG.D10.FR.001-3. Include the Ecosystem services IAM module

Description: The Ecosystem services IAM module must be provided by the Impact assessment module.

4.1.11.1.3.1 AG.D10.FR.001-3-1. Model and provide ecosystems services KPIs categorized

Description: The Ecosystem services IAM module must model and provide ecosystems services related KPIs calculation.

4.1.12 D11: Policy environment module

4.1.12.1 AG.D11.FR.001. Include Policy making

Description: The Policy environment module have to include the Policy making submodule

4.1.12.1.1 AG.D11.FR.001-1. Connected to the agent-based simulation module via the external interface module

Description: The Policy making submodule must be connected to the agent-based simulation module via the external interface module.

4.1.12.1.2 AG.D11.FR.001-2. Translate the policy schemes of interest into the AGRICORE simulation environment

Description: The Policy making submodule must be able to define a policy and translate it into an input for the simulation engine.

4.1.12.1.3 AG.D11.FR.001-3. Agents' model structures modification

Description: The Policy making submodule have to introduce the necessary modifications of the agents' model structures as a previous step to the agents' instantiation.

4.1.12.1.4 AG.D11.FR.001-4. Flexible definition of the support instruments

Description: The Policy making submodule have to enable the flexible definition of the support instruments, covering both, the ones used in Common Agricultural Policy (CAP) first pillars as well as the more targeted and potentially complex ones used for CAP second pillar and post-2020 policies.

4.1.12.2 AG.D11.FR.002. Include Policy impact assessment

Description: The Policy environment module have to include the Policy impact assessment submodule.

4.1.12.2.1 AG.D11.FR.002-1. Connected to the agent-based simulation module via the external interface module

Description: The Policy impact assessment submodule must be connected to the agent-based simulation module via the external interface module.

4.1.12.2.2 AG.D11.FR.002-2. Calculate main KPI's linked to specific agricultural policies

Description: The Policy impact assessment submodule must calculate the main KPI's linked to specific agricultural policies.

4.1.13 D12: Agricore interface module

4.1.13.1 AG.D12.FR.001. Centralize the interaction of the users with the AGRICORE suite

Description: The AGRICORE interface module should centralize all the interaction of the users with the AGRICORE suite.

4.1.13.2 AG.D12.NFR.001. Developed as a cross-platform desktop application web technologies

Description: The Agricore interface module will be implemented as a cross-platform desktop application using web technologies. The application should be compatible with the Chrome web browser.

4.2 Platform customisation requirements

The AGRICORE tool will be made as a highly modular and customisable open source project so that institutions can update and improve the tool transparently as needed. Due to this highly modular feature, the main AGRICORE tool could work with different heterogeneous data as input and output depending on the specific case of the user. Because of this, the AGRICORE tool will provide a different mechanism to customise the platform according to user requirements.

This abstraction capabilities will be converging in a GUI entry point that allows to the users to work and interact with the desired output, that involves different types of data and scopes, configuring the desired dashboards to display them. The AGRICORE suite provides two different tools to interact with the output data for analysis and display. Next figure shows the data analyst tools, with the shadowed connection with ARDIT tool.

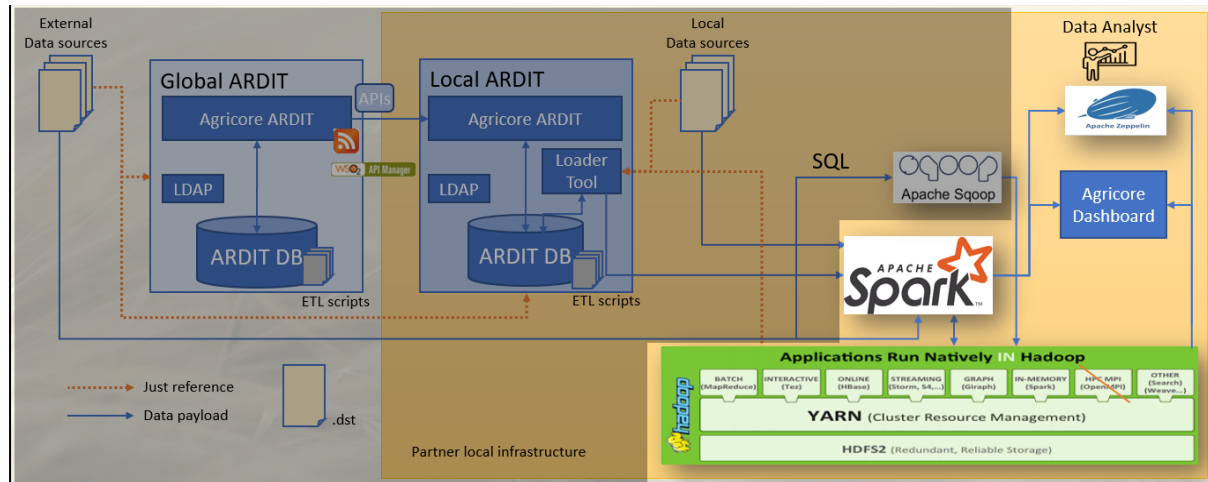


Figure 5 Data analyst tools

The main tool for this purpose is the dashboard AGRICORE interface that will be implemented in the WP4. This platform, oriented to non-expert users, is a cross-platform web application that allows the user to configure different available modules in the dashboard, selecting the desired chart types, colours and data displayed, always keeping user-friendliness as a centric aspect for the implementation. Since modularity and decoupling are two of the main requirements encompassed by the AGRICORE suite, external graphical modules may be integrated by other research that requires extending the functionality provided by the AGRICORE interface. All the aspects described will allow to generate different types of dashboards according to the user requirements.

Another tool has been provided for more experienced users which is called Zeppelin. Zeppelin is a Web-based notebook that enables data-driven, interactive data analytics and collaborative documents with SQL, Scala and more. In the AGRICORE architecture context, Zeppelin allows to interact with the DWH using the programming language Spark or PySpark. A researcher can interact with the information stored in the DWH to operate with them, making specific analyses and plotting the results in customisable charts^[6]. Next figure shows Zeppeling interface.

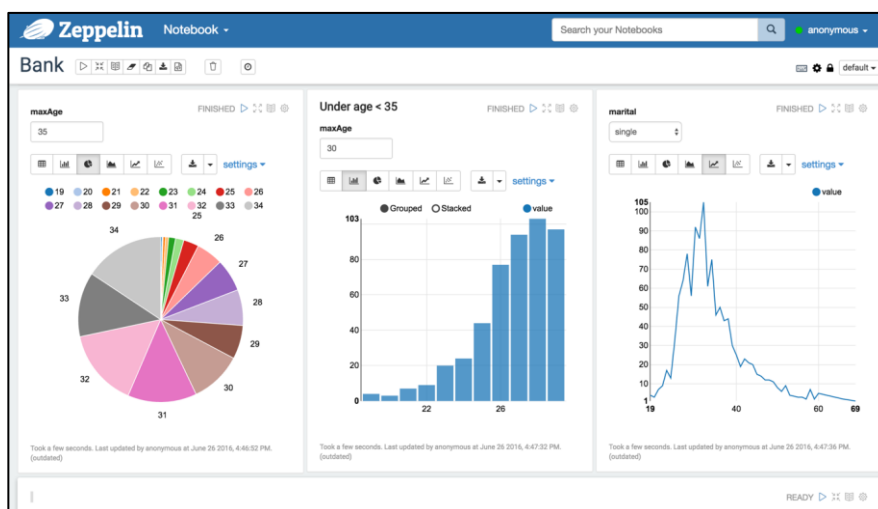


Figure 6 Examples of Zeppelin charts

Zeppelin is not a so user-friendly tool as it requires programming knowledge to interact with it. However, this platform can help during the analysis, development and testing processes throughout the life cycle of the AGRICORE project as well as for a detailed analysis of an use case execution results by researchers familiar with it. For example, this technique will allow to implement the recovery operations while the AGRICORE interface is under development, without blocking the other tasks that can be performed in parallel.

5. Testing

Even if testing is not the main scope of this deliverable, it is important to mention and plan the testing of the requirements while they are being developed. That's the main reason why one of the characteristics to define a requirement include the field "Test", to include the tag "yes" or "not", so once the requirement is tested, the label will change from "no" to "yes" and monitor this activity.

Software testing is one of the software development core activities that consists of the dynamic verification that a program provides expected behaviours on a finite set of test cases, suitably selected from the usually infinite execution domain, and verifying that the software product assurance the quality levels expected. Software testing is a process that have different targets, and at this stage of the project is important to clearly define our focus on the main core activity of ensuring product quality levels by using different types of methodologies, frameworks and practices to obtain the expected results (i.e. security testing, acceptance testing, compatibility testing)^[7]. Depending on the development methodology, software testing can be developed and performed during development (agile techniques) or after the development process (waterfall development) among other. During the AGRICORE project, testing operations will be carried out throughout the project and the methodology to be used during the development is called Continuous Integration (CI) more linked to the agile techniques instead of waterfall development.

Continuous Integration is a software development practice where all developers integrate their working copies frequently in a single shared main line, allowing for early detection of problems. Many teams find that this approach leads to significantly reduction in integration problems and allows a team to develop cohesive software more quickly^[8].

All the developments, when they are going to be merged into the unified line, will be accompanied with their test sets, allowing all tests available in the tool suite to be executed. Making use of CI/CD (Continuous integration and Continuous Delivery) software platforms, these tests could be automatically executed when a developer is going to merge his work with the shared mainline, provided with mechanisms to notify developers that one or more tests are not working properly during the integration process. GitLab provides an automatic mechanism for performing these integration and delivery tasks, which need to be tested in the next months because the AGRICORE consortium has just received a GitLab Gold subscription that enables this functionality, increasing the minutes monthly quota of CI pipelines^[9].

Although the software testing mechanism has different testing levels, two of them will be applied to achieve the main objective of the testing software development core activity. These two testing levels will be Unity testing and Acceptance testing. These different techniques, with the combination of CI/CD, will allow to have a continuous and automatic process that verifies the consistency, performance and security of the AGRICORE project.

Unit testing refers to tests that verify the functionality of a specific section of scope, usually at the level of a function or method. This minimal unit test allows to check that the operation to be performed by a specific function satisfied its purpose, using different types of input data to also verify the security level of the implementation^[10].

Acceptance testing is a test conducted to determine whether the requirement of a specification or contract is met. Formal testing with respect to the users' needs, requirements and business processes, conducted to determine whether a system satisfies the acceptance criteria and to allow users, customers or other authorised entity to determine whether to accept the system^[11]. During the development of the AGRICORE project, the main requirements must be validated through a specific acceptance test implemented to verify that a requirement has been met. There are some requirements that cannot be validated by an automatic process, due to technical limitations or

their nature. In these specific cases, other resources could be used to validate that a requirement has been met (e.g. Reference to a document, report)

6. Conclusions

This deliverable D4.1 provided a whole overview about the 4 main goals that requirements need to cover along the project lifespan development:

- Establish a methodology to manage requirements along the whole lifespan of the project: a conscientious study was done in order to adapt the methodology proposed to the wider cases that can be covered in the project
- Defining high-level requirements: they will be the base to build up low level requirements in a later stage of the project.
- Mapping defined requirements with methodology: GitLab platform gathers all the requirements defined along the deliverable. Screenshots have been included to show how they have been worked.
- Testing requirements: Continuous Integration methodology has been chosen in order to ensure expected quality.

Annex A: Requirements mapped in GitLab platform

In this annex, all the requirements registered in GitLab are recovered grouped by module. Section 6 "Requirements: Functional and Non functional" gathers all the first work of identify and classify all the requirements. Following the methodology explained in section 4, all these requirements have been introduced in the Gitlab Repository of the project as Epics and Issues of the general group "AGRICORE".

Once logged in GitLab, the group AGRICORE has the EPIC button on the left side as it can be shown in the image. In this group, all the modules defined are defined for future developments.

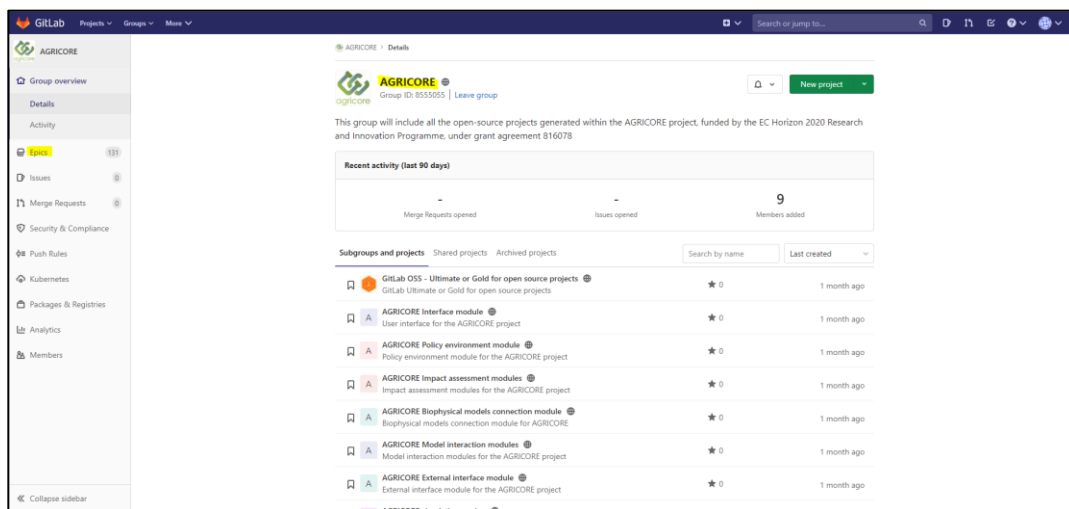


Figure 7 AGRICORE group: EPICS declaration

After accessing to the EPIC section, next screen is shown, where all requirements can be seen as a list, and also can be filtered according to the need of visualisation by clicking on the labels declared and also including further cumulative filters in the bar. Next image shows an example about a filter to show the ARDIT requirements, filtered only by Functional Requirements (FR)

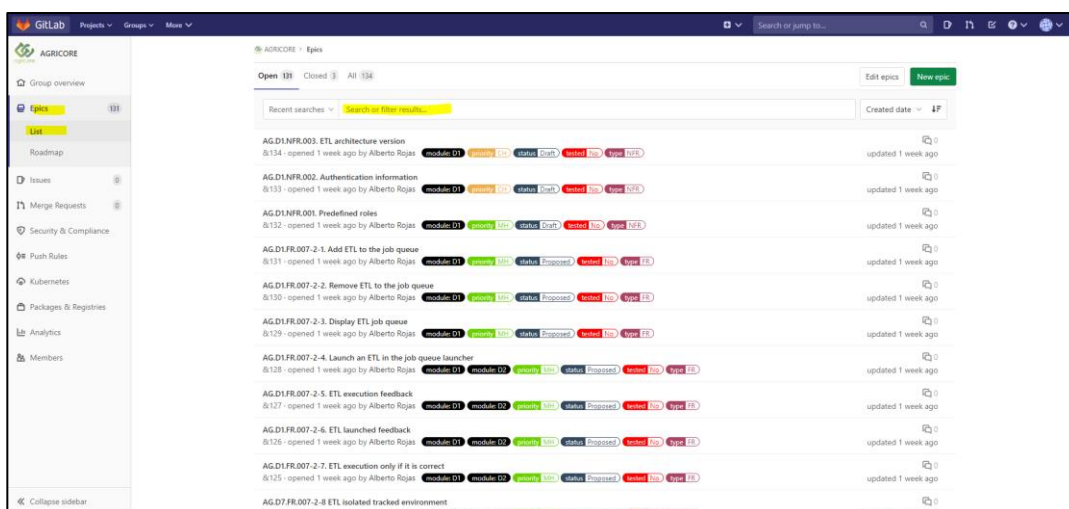


Figure 8 Example of filtering requirements (1/2)

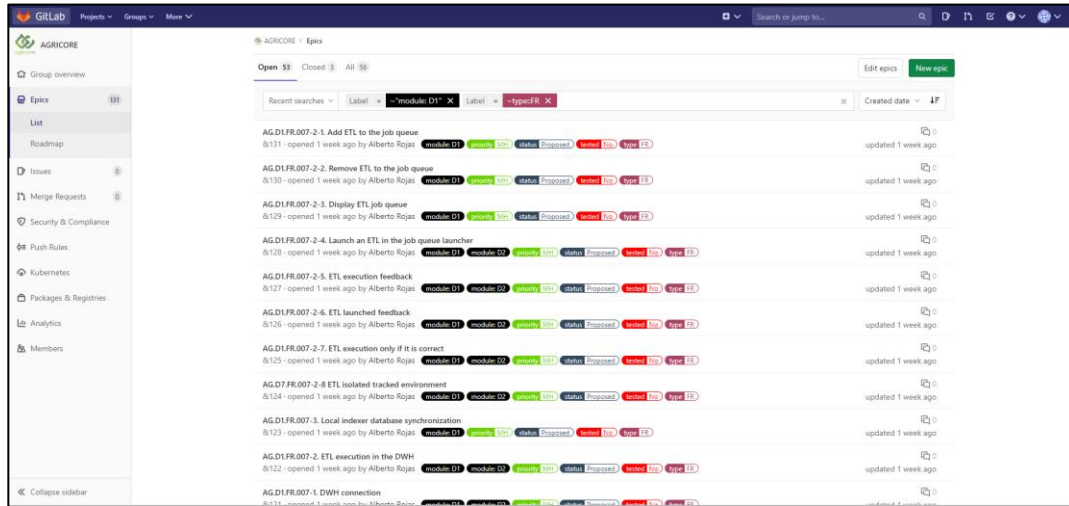


Figure 9 Example of filtering requirements (2/2)

Next images show how all the requirements are seen in the Gitlab group

D0: General requirements

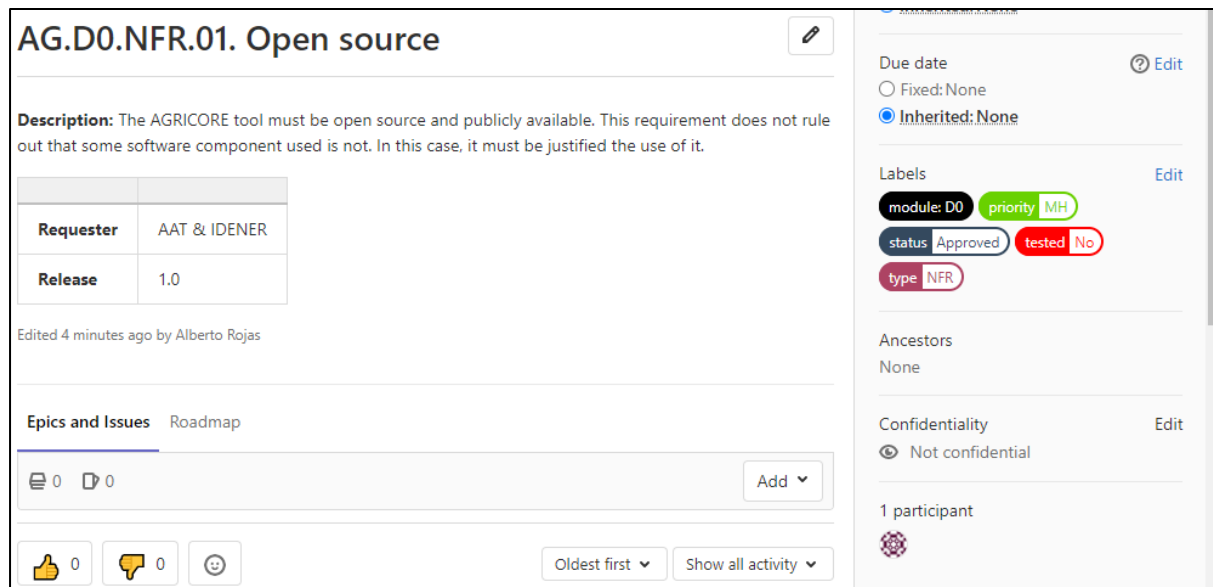


Figure 10 AG.D0.NFR.001. Open source

AG.D0.NFR.002. Institutions can transparently update and improve the tool as needs arise

Definition: The AGRICORE tool should be available in a public repository for anyone who wants to update and improve any of the tools it consists of. The governance of the repositories will always be the partners involved in the AGRICORE consortium during and after the development of the project, led by the main coordinator of the project (IDENER).

Requester	AAT & IDENER
Release	1.0

Edited 4 minutes ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ Inherited: None

Labels
 module: D0 priority MH
 status Approved tested No
 type NFR

Ancestors
None

Confidentiality
☒ Not confidential

1 participant

Figure 11 AG.D0.NFR.002. Institutions can transparently update and improve the tool as needs arise

AG.D0.NFR.003. Modularity of agents

Definition: The modules that are involved in the AGRICORE tool such as Land Market module or Biophysical module must be implemented using the same communication interfaces, format and data structures.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

2 0 Add

- AG.D0.NFR.003-2. Reuse of the individual modules in other solutions
agricore&5 0 0
- AG.D0.NFR.003-1. Allow the substitution of the modules of the platform by others developed by other researcher
agricore&4 0 0

Inherited: None

Due date
☐ Fixed: None
☒ Inherited: None

Labels
 module: D0 priority MH
 status Approved tested No
 type NFR

Ancestors
None

Confidentiality
☒ Not confidential

1 participant

Notifications ☒

Figure 12 AG.D0.NFR.003. Modularity of agents

AG.D0.NFR.003-1. Allow the substitution of the modules of the platform by others developed by other researcher

Definition: The main modules developed in the system (such as Land Market module, Biophysical modules, etc.) must be developed following a defined communication pattern to ensure the complete modularisation of the modules that are involved in the system. The modules must have the property of potentially being replaced by another implementation, abiding by the output interface diagrams.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D0 priority: MH status: Approved tested: No type: NFR

Ancestors

AG.D0.NFR.003. Modularity of agents

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 13 AG.D0.NFR.003-1. Allow the substitution of the modules of the platform by other developed by other researcher

AG.D0.NFR.003-2. Reuse of the individual modules in other solutions

Definition: The main modules developed in the system (such as the Land Market module, Biophysical modules, etc.) have to be isolated from the AGRICORE platform to provide reuse in other ecosystems outside AGRICORE.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D0 priority: MH tested: No type: NFR status: Approved

Ancestors

AG.D0.NFR.003. Modularity of agents

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 14 AG.D0.NFR.003-2. Reuse of the individual modules in other solutions

AG.D0.NFR.004. The architecture will be defined to allow making use of the high computing capabilities of the cloud infrastructure

Definition: The architecture defined must to have the capabilities to externalise the execution of the high computing operations, using external mathematical modules or systems.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ Inherited: None

Labels
 module: D0 priority: MH
 status: Approved tested: No
 type: NFR

Ancestors
None

Confidentiality
☒ Not confidential

1 participant

Figure 15 AG.D0.NFR.004. The architecture will be defined to allow making use of the high computing capabilities of the cloud infrastructure

AG.D0.NFR.005. The architecture will be defined as Cloud-independent, allowing the use of cloud infrastructures both at public and private levels

Definition: The architecture has to be able of being executed in different cloud services, making use of operative system (OS) isolation technologies such as Docker. The development of different deployment scripts for a wide range of cloud providers is not a requirement.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ Inherited: None

Labels
 module: D0 priority: MH
 status: Approved tested: No
 type: NFR

Ancestors
None

Confidentiality
☒ Not confidential

1 participant

Figure 16 AG.D0.NFR.005. The architecture will be defined as Cloud-independent, allowing the use of cloud infrastructures both at public and private levels

AG.D0.NFR.006. Strong focus on data security

Definition: The AGRICORE suite will allow the definition of private and public sections.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date
☐ Fixed: None
☒ Inherited: None

Labels
 module: D0 priority MH
 status Approved tested No
 type NFR

Ancestors
 None

Confidentiality
☒ Not confidential

Figure 17 AG.D0.NFR.006. Strong focus on data security

AG.D0.NFR.007. Standardise the communication between the external models and the rest of the suite

Definition: The ontologies and communication interfaces between the modules will be specified to know the communication protocols, formats, data structure, schemas and data types.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date
☐ Fixed: None
☒ Inherited: None

Labels
 module: D0 priority MH
 status Approved type NFR
 tested No

Ancestors
 None

Confidentiality
☒ Not confidential

1 participant

Figure 18 AG.D0.NFR.007. Standardise the communication between the external models and the rest of the suite

D1: ARDIT

AG.D1.FR.001. Provide a publicly accessible index of agriculture data sources

Description: ARDIT must provide a publicly accessible index of data sources available for agriculture policy assessment.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ **Inherited: None**

Labels
 Edit
 module: D1 priority MH
 status Approved tested No
 type FR

Ancestors
 None

Confidentiality
 Edit
☒ Not confidential

1 participant

Figure 19 AG.D1.FR.001. Provide a publicly accessible index of agriculture data sources

AG.D1.FR.002. Available for all stakeholders

Description: The ARDIT platform must be publicly available for all stakeholders (from data analysts to policy makers and researchers).

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ **Inherited: None**

Labels
 Edit
 module: D1 priority MH
 status Approved tested No
 type FR

Ancestors
 None

Confidentiality
 Edit
☒ Not confidential

1 participant

Figure 20 AG.D1.FR.002. Available for all stakeholders

AG.D1.FR.003. Store relevant information of the data sources

Description: ARDIT must allow the registration and modification of data sources according to the ontology (AGRICORE DCAT-AP 2.0 extension), as well as to be easily updated to adapt to the evolution of the ontology. Relevant data from the datasources such as:

- Fields.
- Spatial scope.
- Resolution.
- Agregation level.
- Update frequency.
- Last update available.
- Privacy level of the data.
- Accessibility

Requester	AAT & IDENER
Release	1.0

Inherited: None

Due date
☐ Fixed: None
☒ **Inherited:** None

Labels
 module: D1 priority MH
 status Approved tested No
 type FR

Ancestors
 None

Confidentiality
☒ Not confidential

1 participant

Figure 21 AG.D1.FR.003. Store relevant information of the data sources

AG.D1.FR.004. Researchers will be able to extend its scope with additional data sources

Description: ARDIT must have a mechanism for extending the scope of the tool with the addition of further data sources to the tool by researchers. Researchers may add or suggest new data sources depending on the level of authorisation they have.

Requester	AAT & IDENER
Release	1.0

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ **Inherited:** None

Labels
 module: D1 priority MH
 status Approved tested No
 type FR

Ancestors
 None

Confidentiality
☒ Not confidential

1 participant

Figure 22 AG.D1.FR.004. Researchers will be able to extend its scope with additional data sources

AG.D1.FR.005. Semantic search will be allowed

Description: ARDIT allows semantic searches using a dedicated API developed in the WP4 to identify datasets and other similar ones. However, ARDIT does not allow finding data within a dataset. For example, a search could be done using natural language such as: 'PH data from Italy between 2018 and 2019'.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Start date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D1 priority SH

status Approved tested No

type FR

Ancestors

None

Figure 23 AG.D1.FR.005. Semantic search will be allowed

AG.D1.FR.006. Advanced search will be allowed

Description: ARDIT allows advanced search for experienced researches, using the GUI (Graphical User Interface) to select specific attributes and values to retrieve the datasets indexed in the tool.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

☒ **Inherited: None**

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D1 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 24 AG.D1.FR.006. Advanced search will be allowed

AG.D1.FR.007. Local deployment capability

Description: ARDIT could provide a way to deploy the tool in a private environment, allowing the possibility to be synchronised with the ARDIT global tool to retrieve the new public datasets indexed.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D1 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 25 AG.D1.FR.007. Local deployment capability

D2: DWH

AG.D2.FR.001. Centralise the information exchange within the AGRICORE IT architecture

Description: The system should centralise all information exchange within all AGRICORE modules. DWH could be deployed in a cloud, in a local architecture or both.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D2 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 26 AG.D2.FR.001. Centralise the information exchange within the AGRICORE IT architecture

AG.D2.FR.002. Use a combination of SQL and non-SQL databases massive parallel programming (MMP) technology and/or Hadoop/Spark

Description: The system must provide high computing technologies using a combination of SQL and non-SQL databases and/or Hadoop/Spark to execute high-demand operations.

Requester	AAT & IDENER
Release	1.0

Edited 41 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ Inherited: None

Labels
 module: D2 priority MH
 status Approved tested No
 type FR

Ancestors
None

Confidentiality
☒ Not confidential Edit

1 participant

Figure 27 AG.D2.FR.002. Use a combination of SQL and non-SQL databases massive parallel programming (MMP) technology and/or Hadoop/Spark

AG.D2.FR.003. Provide high-performance analysis capabilities to the DWH

Description: DWH must provide technical capabilities to launch high-performance operations such as Spark. These operations could have different purposes such as data extraction, processing and generation, among others.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ Inherited: None

Labels
 module: D2 status Approved
 tested No type FR priority MH

Ancestors
None

Confidentiality
☒ Not confidential Edit

1 participant

Figure 28 AG.D2.FR.003. Provide high-performance analysis capabilities to the DWH

AG.D2.FR.004. Easy-to-manage access permissions

Description: DWH must provide an access permissions using the permission mechanism provided by Hadoop.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D2 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 29 AG.D2.FR.004. Easy-to-manage access permissions

AG.D2.FR.005. Separate critical/private information from information suited to be made public

Description: The DWH must be able to separate different information sections as private and public. The ETL developers should have administrator access to the system but not for ETL launchers.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

☒ Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D2 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 30 AG.D2.FR.005. Separate critical/private information from information suited to be made public

AG.D2.FR.006. Support both private and public cloud infrastructure deployment

Description: The DWH system must be able to be deployed in public and private cloud architectures.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D2 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 31 AG.D2.FR.006. Support both private and public cloud infrastructure deployment

D3: Data extraction module

AG.D3.FR.001. Data of interest extraction

Description: The data extraction module must be able to extract all the data of interest from the multiple datasets considered in the project. Not all the attributes might be necessary to build the synthetic individuals, but only the attributes of interest. Data extraction encompasses the capabilities for accessing the various databases (DBs), selecting the necessary data and formatting it for further processing.

Requester	AAT & IDENER
Release	1.0

Edited 48 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

☒ Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D3 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 32 AG.D3.FR.001. Data of interest extraction

AG.D3.FR.002. Distribution curves generation

Description: The data extraction module must allow the generation of distribution curves of individual variables inside datasets involved in the case. The user case implemented should extract the distribution curves (both individual and joint) from all the datasets involved in the use case.

Requester	AAT & IDENER
Release	1.0

Edited 1 minute ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date [? Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D3 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 33 AG.D3.FR.002. Distribution curves generation

AG.D3.FR.003. Optimised data extraction operations

Description: The module must provide optimised data extraction operations in terms of computational efficiency and speed using the capabilities offered by Spark.

Requester	AAT & IDENER
Release	1.0

Edited 41 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date [? Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D3 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 34 AG.D3.FR.003. Optimised data extraction operations

AG.D3.FR.004. Data output stored in DHW

Description: The module must provide its output storing the results in the DWH.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D2 module: D3

priority MH status Approved

tested No type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

Figure 35 AG.D3.FR.004. Data output stored in DHW

D4: Data fusion module

AG.D4.FR.001. Infer the underlying joint probability distribution by means of statistical inference methods

Description: The data fusion module must combine the individualised data with the probability distributions of the variables to generate the joint probability distributions for the main attributes describing the population of interest. The data fusion module includes the generation, from the extracted data, of any statistical parameter or statistical function, which can later be used both for population synthesis and for the comparison of synthetic population with the real population, by comparing its statistical measures. The data fusion module should be composed by a statistical functions generator and a statistical parameters calculator sub modules.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D4 priority MH tested No

type FR status Approved

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 36 AG.D4.FR.001. Infer the underlying joint probability distribution by means of statistical inference methods

AG.D4.FR.002. Data output stored in the DHW

Description: The data fusion module must provide its output storing the results in the DWH.

Requester	AAT & IDENER
Release	1.0

Edited 41 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ **Inherited: None**

Labels
 module: D2 module: D4
 priority MH status Approved
 tested No type FR

Ancestors
None

Confidentiality
☒ Not confidential

Figure 37 AG.D4.FR.002. Data output stored in the DHW

D5: Synthetic populations generator

AG.D5.FR.001. Synthetic Reconstruction method

Description: The system must be able to make the Synthetic Reconstruction method aimed to obtain realistic synthetic populations. The module creates successive empty individuals, and either sequentially or globally assign values to the attributes of interest considered.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ **Inherited: None**

Labels
 module: D5 priority MH
 status Approved tested No
 type FR

Ancestors
None

Confidentiality
☒ Not confidential

1 participant

Figure 38 AG.D5.FR.001. Synthetic Reconstruction method

AG.D5.FR.002. Match the distribution of the agents' population of interest taking account of the joint probability distributions

Description: The module has to compare the goodness-of-fit of the population generated. If the population result does not fit enough, the module should be able to modify the values of the attributes of the agents until the goodness of fit is acceptable.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D5 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

Figure 39 AG.D5.FR.002. Match the distribution of the agents' population of interest taking account of the joint probability distributions

AG.D5.FR.003. Receives input from the Data fusion module

Description: The synthetic population generator must receive input information from the Data fusion module, although the module could have simple and joint distribution curves pre-calculated and stored in the module.

Requester	AAT & IDENER
Release	1.0

Edited 41 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D4 module: D5

priority MH status Approved

tested No type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 40 AG.D5.FR.003. Receives input from the Data fusion module

AG.D5.FR.004. Data output stored in the DHW

Description: The module must provide its output storing the results in the DWH.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D2 module: D5

priority MH status Approved

tested No type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

Figure 41 AG.D5.FR.004. Data output stored in the DHW

D6: ABM simulation engine

AG.D6.FR.001. Simulate the evolution of the ABM population

Description: The ABM simulation engine must instantiate agents for each farmer generated in the Synthetic population generator. Each agent evaluates its situation and makes a decision based on its preferences, generating an output consisting of the evolution of each agent.

Requester	AAT & IDENER
Release	1.0

Edited 4 minutes ago by Alberto Rojas

Epics and Issues Roadmap

3 0 Add

- AG.D6.FR.001-1. Simulations are based on Synthetic population module data
agricore&34 0 0
- AG.D6.FR.001-2. Agents will be instantiated according to the synthetic population already generated
agricore&35 0 0
- AG.D6.FR.001-3. Will be connected to a mathematical solver in order to perform the iterations needed to simulate the evolution of the agents
agricore&36 0 0

To Do [Add a To-Do](#) »

Start date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D6 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Notifications ☒

Figure 42 AG.D6.FR.001. Simulate the evolution of the ABM population

AG.D6.FR.001-1. Simulations are based on Synthetic population module data

Description: The ABM simulation engine must use the data provided by the Synthetic population generator.

Requester	AAT & IDENER
Release	1.0

Edited 1 minute ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ Inherited: None

Labels
module: D5 module: D6
priority MH status Approved
tested No type FR

Ancestors
☒ AG.D6.FR.001. Simulate the evolution of the ABM population

Confidentiality
☒ Not confidential

Figure 43 AG.D6.FR.001-1. Simulations are based on Synthetic population module data

AG.D6.FR.001-2. Agents will be instantiated according to the synthetic population already generated

Description: The ABM simulation engine must instantiate the agents according the data recovered.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date
☐ Fixed: None
☒ Inherited: None

Labels
module: D6 priority MH
status Approved tested No
type FR

Ancestors
☒ AG.D6.FR.001. Simulate the evolution of the ABM population

Confidentiality
☒ Not confidential

1 participant

Figure 44 AG.D6.FR.001-2. Agents will be instantiated according to the synthetic population already generated

AG.D6.FR.001-3. Will be connected to a mathematical solver in order to perform the iterations needed to simulate the evolution of the agents

Description: The ABM simulation engine must be connected to a mathematical solver to perform the agent evaluation. Each agent evaluates its situation and makes a decision based on its preferences, generating an output consisting of the evolution of each agent.

Requester	AAT & IDENER
Release	1.0

Edited 41 seconds ago by Alberto Rojas

Inherited: None

Due date
☐ Fixed: None
☒ Inherited: None

Labels
 module: D6 priority MH status Approved tested No type FR

Ancestors
 AG.D6.FR.001. Simulate the evolution of the ABM population

Confidentiality
☒ Not confidential

Figure 45 AG.D6.FR.001-3. Will be connected to a mathematical solver in order to perform the iterations needed to simulate the evolution of the agents

AG.D6.FR.002. Manage the interactions required with the external modules

Description: The ABM simulation engine must manage the interaction required with the external simulation modules of the system.

Requester	AAT & IDENER
Release	1.0

Edited 8 minutes ago by Alberto Rojas

To Do Add a To-Do »

Start date
☐ Fixed: None
☒ Inherited: None

Due date
☐ Fixed: None
☒ Inherited: None

Labels
 module: D6 module: D7 priority MH status Approved tested No type FR

Ancestors
 None

Confidentiality
☒ Not confidential

1 participant

Notifications ☒

Epics and Issues Roadmap

4 0 Add

- AG.D6.FR.002-1. Interaction with the land module
 agricore&38 0 0
- AG.D6.FR.002-2. Interaction with the markets module
 agricore&39 0 0
- AG.D6.FR.002-3. Interaction with the environment module
 agricore&40 0 0
- AG.D6.FR.002-4. Interactions with the biophysical module
 agricore&41 0 0

Figure 46 AG.D6.FR.002. Manage the interactions required with the external modules



AG.D6.FR.002-1. Interaction with the land module

Description: The ABM simulation engine must manage the interaction with the land module.




Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

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
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Inherited: None

Due date  [Edit](#)


☐ Fixed: None

☒ **Inherited: None**


Labels [Edit](#)

module: D6
priority MH
status Approved
tested No
type FR

Ancestors

 AG.D6.FR.002. Manage the interactions required with the external modules

Confidentiality [Edit](#)

 Not confidential

1 participant

Figure 47 AG.D6.FR.002-1. Interaction with the land module



AG.D6.FR.002-2. Interaction with the markets module

Description: The ABM simulation engine must manage the interaction with the markets module.

Requester	AAT & IDENER
Release	1.0


Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

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Inherited: None

Due date  [Edit](#)


☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D6
priority MH
status Approved
tested No
type FR

Ancestors

 AG.D6.FR.002. Manage the interactions required with the external modules

Confidentiality [Edit](#)


 Not confidential

Figure 48 AG.D6.FR.002-2. Interaction with the markets module

AG.D6.FR.002-3. Interaction with the environment module

Description: The ABM simulation engine must manage the interaction with the environment module.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D6 priority MH status Approved tested No type FR

Ancestors

AG.D6.FR.002. Manage the interactions required with the external modules

Confidentiality [Edit](#)

☒ Not confidential

Figure 49 AG.D6.FR.002-3. Interaction with the environment module

AG.D6.FR.002-4. Interactions with the biophysical module

Description: The ABM simulation engine must manage the interaction with the biophysical module.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D6 module: D9 priority MH status Approved tested No type FR

Ancestors

AG.D6.FR.002. Manage the interactions required with the external modules

Confidentiality [Edit](#)

☒ Not confidential

Figure 50 AG.D6.FR.002-4. Interactions with the biophysical module

AG.D6.FR.003. Include the farm ABM model

Description: The Agent model (the farm model) should be the unit that is simulated in the simulation engine.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D6 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 51 AG.D6.FR.003. Include the farm ABM model

AG.D6.NFR.001. Fully object-oriented implementation

Description: The ABM model must be implemented with the object oriented programming paradigm.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D6 priority MH

status Approved tested No

type NFR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 52 AG.D6.NFR.001. Fully object-oriented implementation

AG.D6.NFR.002. Allow a set of high performance computing features

Description: The ABM simulation engine must include some methods ensuring high-performance computing of the embedded optimisation problems.

Requester	AAT & IDENER
Release	1.0

Edited 1 minute ago by Alberto Rojas

Epics and Issues Roadmap

4 0 Add

AG.D6.NFR.002-1. Exploitation of parallel processing and cloud computing environment capabilities
agricore&45 0 0

AG.D6.NFR.002-2. Evaluate the execution in GPU-based architectures
agricore&46 2 0

AG.D6.NFR.002-3. Use of latest releases of best rated off-the-shelf mathematical solvers
agricore&47 0 0

AG.D6.NFR.002-4. Implementation of warm-start techniques
agricore&48 1 0

To Do Add a To-Do »

Start date ? Edit
☐ Fixed: None
☒ Inherited: None

Due date ? Edit
☐ Fixed: None
☒ Inherited: None

Labels Edit
 module: D6 priority MH
 status Approved tested No
 type NFR

Ancestors
None

Confidentiality Edit
☒ Not confidential

1 participant

Notifications ☒

Figure 53 AG.D6.NFR.002. Allow a set of high performance computing features

AG.D6.NFR.002-1. Exploitation of parallel processing and cloud computing environment capabilities

Description: ABM simulation engine must exploit the capabilities of parallel processing and cloud computing.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date ? Edit
☐ Fixed: None
☒ Inherited: None

Labels Edit
 module: D6 priority MH
 status Approved tested No
 type NFR

Ancestors
☒ AG.D6.NFR.002. Allow a set of high performance computing features

Confidentiality Edit
☒ Not confidential

1 participant

Figure 54 AG.D6.NFR.002-1. Exploitation of parallel processing and cloud computing environment capabilities

AG.D6.NFR.002-2. Evaluate the execution in GPU-based architectures

Description: Evaluation of the ABM simulation engine execution in GPU-based architectures.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D6 priority CH

status Approved tested No

type NFR

Ancestors

AG.D6.NFR.002. Allow a set of high performance computing features

Confidentiality [Edit](#)

☒ Not confidential

Figure 55 AG.D6.NFR.002-2. Evaluate the execution in GPU-based architectures

AG.D6.NFR.002-3. Use of latest releases of best rated off-the-shelf mathematical solvers

Description: Allow the use of latest releases of best rated off-the-shelf mathematical solvers such as IBM CPLEX MIQCP, GUROBI or open sources alternatives.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D6 priority MH

status Approved tested No

type NFR

Ancestors

AG.D6.NFR.002. Allow a set of high performance computing features

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 56 AG.D6.NFR.002-3. Use of latest releases of best rated off-the-shelf mathematical solversnt

AG.D6.NFR.002-4. Implementation of warm-start techniques

Description: Allow the use of warm-start techniques implementation. Optimised calls to the solver taking advantage of tentative solutions already available from other similar agents.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D6 priority MH

status Approved tested No

type NFR

Ancestors

AG.D6.NFR.002. Allow a set of high performance computing features

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 57 AG.D6.NFR.002-4. Implementation of warm-start techniques

D7: External Interface module

AG.D7.FR.001. Serve as a central point of link for the agent based simulation module with the set of external modules

Description: The external interface module should act as a gateway for the interoperability between the modules to the ABM simulation engine.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D6 module: D7

priority MH status Approved

tested No type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 58 AG.D7.FR.001. Serve as a central point of link for the agent based simulation module with the set of external modules

AG.D7.FR.002. Exploit the ontologies to be established within the project

Description: The external interface module must exploit the ontologies defined for its communication interfaces exposed to the other modules.

Requester	AAT & IDENER
Release	1.0

Epics and Issues Roadmap

0 0 Add

Due date [? Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D7 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 59 AG.D7.FR.002. Exploit the ontologies to be established within the project

AG.D7.NFR.001. Facilitate the incorporation of additional external modules by other researchers

Description: The external interface module must meet the specifications in terms of information exchange and the exploitation of the ontologies to be established within the project to facilitate the incorporation of additional external modules by other researchers.

Requester	AAT & IDENER
Release	1.0

Epics and Issues Roadmap

0 0 Add

Due date [? Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D7 priority MH

status Approved tested No

type NFR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 60 AG.D7.NFR.001. Facilitate the incorporation of additional external modules by other researchers

D8: Model interaction modules

AG.D8.FR.001. Interact with the simulation engine

Description: The Model interaction modules have to interact with the simulation engine through the external interface modules.

Requester	AAT & IDENER
Release	1.0

Epics and Issues Roadmap

0 0 Add

Inherited: None

Due date ? Edit

☐ Fixed: None

☒ **Inherited: None**

Labels Edit

module: D7 module: D8

priority MH status Approved

tested No type FR

Ancestors

None

Confidentiality Edit

☒ Not confidential

Figure 61 AG.D8.FR.001. Interact with the simulation engine

AG.D8.FR.002. Include the next modules

Description: The Model interaction modules must include the different modules enumerated below:

- Land Module: This module must include a land market that enables the interaction of the farmers by allowing them to place bid/ask orders according to the land market prices.
- Markets module: This module must simulate the dynamics of the production market prices and considering additional market feedbacks as production factors.
- Biophysical module: This module must be linked to BioMA (Biophysical Model Applications) platform unless a better alternative is identified and validated by the stakeholders (JRC, DG.AGRI) and accepted by the REA).
- ARPEGE module: This module must be linked to an ARPEGE (global numeric weather prediction) model data provider.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

9 0 Add

- AG.D8.FR.002-1. Include the Land module ×
agricore&54 1 0
- AG.D8.FR.002-2. Include the Markets module ×
agricore&56 2 0

To Do Add a To-Do »

Start date ? Edit

☐ Fixed: None

☒ **Inherited: None**

Due date ? Edit

☐ Fixed: None

☒ **Inherited: None**

Labels Edit

module: D8 priority MH

status Approved tested No

type FR


Ancestors

None

Confidentiality Edit

☒ Not confidential

1 participant



Notifications ✓

Figure 62 AG.D8.FR.002. Include the next modules

AG.D8.FR.002-1. Include the Land module

Description: The Land module must be provided by the Model Interaction modules.

Requester	AAT & IDENER
Release	1.0

Edited 1 minute ago by Alberto Rojas

Epics and Issues Roadmap

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Add

AG.D8.FR.002-1-1. Definition of the land module resource transfer mechanism

agricore&55

0

0

X

Inherited: None

Due date ? Edit

☐ Fixed: None

☒ **Inherited: None**

Labels Edit

module: D8 priority IMH

status Approved tested No

type FR

Ancestors

AG.D8.FR.002. Include the next modules

Confidentiality Edit

☒ Not confidential

1 participant

Figure 63 AG.D8.FR.002-1. Include the Land module

AG.D8.FR.002-1-1. Definition of the land module resource transfer mechanism

Description: The Land module must provide a mechanism to transfer agricultural resources between the agents.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0

0

Add

Inherited: None

Due date ? Edit

☐ Fixed: None

☒ **Inherited: None**

Labels Edit

module: D8 priority IMH

status Approved tested No

type FR

Ancestors

AG.D8.FR.002. Include the next modules

AG.D8.FR.002-1. Include the Land module

Confidentiality Edit

☒ Not confidential

Figure 64 AG.D8.FR.002-1-1. Definition of the land module resource transfer mechanism

AG.D8.FR.002-2. Include the Markets module

Description: The Markets module must be provided by the Model interaction modules.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

2

0

Add

AG.D8.FR.002-2-1. Simulate dynamics of production market prices

agricore&57

0

0

AG.D8.FR.002-2-2. Markets module should include additional market dynamics

agricore&58

0

0

Due date

☐ Fixed: None

☒ Inherited: None

Labels

module: D8 priority MH

status Approved tested No

type FR

Ancestors

AG.D8.FR.002. Include the next modules

Confidentiality

☒ Not confidential

1 participant

Figure 65 AG.D8.FR.002-2. Include the Markets module

AG.D8.FR.002-2-1. Simulate dynamics of production market prices

Description: The Markets module must simulate the dynamics of the production market prices.

Requester	AAT & IDENER
Release	1.0

Edited 41 seconds ago by Alberto Rojas

Epics and Issues Roadmap

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0

Add

Due date

☐ Fixed: None

☒ Inherited: None

Labels

module: D8 priority MH

status Approved tested No

type FR

Ancestors

AG.D8.FR.002. Include the next modules

AG.D8.FR.002-2. Include the Markets module

Confidentiality

Edit

Figure 66 AG.D8.FR.002-2-1. Simulate dynamics of production market prices

AG.D8.FR.002-2-2. Markets module should include additional market dynamics

Description: The Markets should include additional market dynamics such as manure, fodder and young animals.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D8 priority MH

status Approved tested No

type FR

Ancestors

- AG.D8.FR.002. Include the next modules
- AG.D8.FR.002-2. Include the Markets module

Confidentiality [Edit](#)

☒ Not confidential

Figure 67 AG.D8.FR.002-2-2. Markets module should include additional market dynamics

AG.D8.FR.002-3. Include the Biophysical models connection module

Description: The Biophysical models connection module must be provided by the Model Interaction modules.

Requester	AAT & IDENER
Release	1.0

Edited 41 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D8 module: D9

priority MH status Approved

tested No type FR

Ancestors

- AG.D8.FR.002. Include the next modules

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 68 AG.D8.FR.002-3. Include the Biophysical models connection module

AG.D8.FR.002-4. Include the ARPEGE module

Description: The ARPEGE module must be provided by the Model Interaction modules.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

2

0

Add

AG.D8.FR.002-4-1. Provides variables from an NWP model

agricore&61

0

0

AG.D8.FR.002-4-2. Provides weather data to Biophysical module.

agricore&62

0

0

Start date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D8 priority MH

status Approved tested No

type FR

Ancestors

AG.D8.FR.002. Include the next modules

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 69 AG.D8.FR.002-4. Include the ARPEGE module

AG.D8.FR.002-4-1. Provides variables from an NWP model

Description: The ARPEGE module must provide a specific number of variables provided by a NWP model. This could be achieved by providing a link to external data providers or from information stored in the DWH.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

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0

Add

Due date [Edit](#)

☐ Fixed: None

☒ **Inherited: None**

Labels [Edit](#)

module: D8 priority MH

status Approved tested No

type FR

Ancestors

AG.D8.FR.002. Include the next modules

AG.D8.FR.002-4. Include the ARPEGE module

Confidentiality [Edit](#)

☒ Not confidential

Figure 70 AG.D8.FR.002-4-1. Provides variables from an NWP model

AG.D8.FR.002-4-2. Provides weather data to Biophysical module.

Description: The ARPEGE module must provide weather forecasts that can be used by the Biophysical module or by any other module that requires it.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D8 priority MH

status Approved tested No

type FR

Ancestors

- AG.D8.FR.002. Include the next modules
- AG.D8.FR.002-4. Include the ARPEGE module

Confidentiality [Edit](#)

☒ Not confidential

Figure 71 AG.D8.FR.002-4-2. Provides weather data to Biophysical module.

D9: Biophysical models connection module

AG.D9.FR.001. Provides biophysical model to the AGRICORE tool

Description: The Biophysical models connection module must to provide a biophysical model to the AGRICORE tool.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D9 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 72 AG.D9.FR.001. Provides biophysical model to the AGRICORE tool

AG.D9.FR.002. Include plant, weather, stress, soil and agriculture management

Description: The biophysical model must provide information about plant, weather, stress, soil and agriculture management.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D9 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 73 AG.D9.FR.002. Include plant, weather, stress, soil and agriculture management

AG.D9.FR.003. Make use of a weather model provider (ARPEGE)

Description: The Biophysical module should access to the ARPEGE weather provider (or any other) to establish the climatic conditions that are affected in the biophysical simulation model.

Requester	AAT & IDENER
Release	1.0

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D9 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 74 AG.D9.FR.003. Make use of a weather model provider (ARPEGE)

D10: Impact assessment module

AG.D10.FR.001. Include next modules

Description: The Impact assessment module must provide the modules enumerated below, which are used to evaluate the KPIs related to their specific topic:

- Environmental / Climate module
- Socio-economic IAM module
- Ecosystem services IAM module

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

6 0 Add

- AG.D10.FR.001-1. Include the Environmental / Climate module
agricore&67 1 0
- AG.D10.FR.001-2. Include the Socio-economic IAM module
agricore&68 1 0
- AG.D10.FR.001-3. Include the Ecosystem services IAM module
agricore&69 1 0

Start date [Edit](#)

☐ Fixed: None
☒ **Inherited: None**

Due date [Edit](#)

☐ Fixed: None
☒ **Inherited: None**

Labels [Edit](#)

module: D10 priority MH
status Approved tested No
type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Notifications ☒

Figure 75 AG.D10.FR.001. Include next modules

AG.D10.FR.001-1. Include the Environmental / Climate module

Description: The Environmental/Climate module must be provided by the Impact assessment module.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

1 0 Add

- AG.D10.FR.001-1-1. Compute the main KPIs related to the environmental and climatic impact assessment
agricore&70 0 0

Due date [Edit](#)

☐ Fixed: None
☒ **Inherited: None**

Labels [Edit](#)

module: D10 priority MH
status Approved tested No
type FR

Ancestors

AG.D10.FR.001. Include next modules

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 76 AG.D10.FR.001-1. Include the Environmental / Climate module



AG.D10.FR.001-1-1. Compute the main KPIs related to the environmental and climatic impact assessment

Description: The Environmental/Climate module must compute the main KPIs related to the environmental and climatic impact assessment.

Requester	AAT & IDENER
Release	1.0


Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

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Add ▾

Inherited: None

Due date  **Edit**

☐ Fixed: None

☒ **Inherited: None**

Labels **Edit**

module: D10
priority: MH
status: Approved
tested: No
type: FR

Ancestors

- AG.D10.FR.001. Include next modules
- AG.D10.FR.001-1. Include the Environmental / Climate module

Confidentiality **Edit**


 Not confidential

Figure 77 AG.D10.FR.001-1-1. Compute the main KPIs related to the environmental and climatic impact assessment

AG.D10.FR.001-2. Include the Socio-economic IAM module

Description: The Socio-economic IAM module must be provided by the Impact assessment module.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

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  0

Add ▾

 AG.D10.FR.001-2-1. Assess the relationship between policy incentives and KPIs related to the integration of agriculture in rural systems 

agricore&71  0  0

Inherited: None

Due date  **Edit**

☐ Fixed: None

☒ **Inherited: None**

Labels **Edit**

module: D10
priority: MH
status: Approved
tested: No
type: FR

Ancestors

- AG.D10.FR.001. Include next modules

Confidentiality **Edit**

 Not confidential

1 participant 

Figure 78 AG.D10.FR.001-2. Include the Socio-economic IAM module

AG.D10.FR.001-2-1. Assess the relationship between policy incentives and KPIs related to the integration of agriculture in rural systems

Description: The Socio-economic IAM module must assess the relationship between policy incentives and KPIs related to the integration of agriculture in rural systems.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D10 priority MH

status Approved tested No

type FR

Ancestors

- AG.D10.FR.001. Include next modules
- AG.D10.FR.001-2. Include the Socio-economic IAM module

Confidentiality [Edit](#)

☒ Not confidential

Figure 79 AG.D10.FR.001-2-1. Assess the relationship between policy incentives and KPIs related to the integration of agriculture in rural systems

AG.D10.FR.001-3. Include the Ecosystem services IAM module

Description: The Ecosystem services IAM module must be provided by the Impact assessment module.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

1 0 Add

AG.D10.FR.001-3-1. Model and provide ecosystems services KPIs categorized
agricore&72 0 0

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D10 priority MH

status Approved tested No

type FR

Ancestors

- AG.D10.FR.001. Include next modules

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 80 AG.D10.FR.001-3. Include the Ecosystem services IAM module

AG.D10.FR.001-3-1. Model and provide ecosystems services KPIs categorized

Description: The Ecosystem services IAM module must model and provide ecosystems services related KPIs calculation.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D10 priority MH

status Approved tested No

type FR

Ancestors

- AG.D10.FR.001. Include next modules
- AG.D10.FR.001-3. Include the Ecosystem services IAM module

Confidentiality [Edit](#)

☒ Not confidential

Figure 81 AG.D10.FR.001-3-1. Model and provide ecosystems services KPIs categorized

D11 : Policy environment module

AG.D11.FR.001. Include Policy making

Description: The Policy environment module have to include the Policy making submodule.

Requester	AAT & IDENER
Release	1.0

Edited 1 minute ago by Alberto Rojas

Epics and Issues Roadmap

4 0 Add

- AG.D11.FR.001-1. Connected to the agent-based simulation module via the external interface module
agricore&74 0 0
- AG.D11.FR.001-2. Translate the policy schemes of interest into the AGRICORE simulation environment
agricore&75 0 0
- AG.D11.FR.001-3. Agents' model structures modification
agricore&76 0 0
- AG.D11.FR.001-4. Flexible definition of the support instruments
agricore&77 0 0

To Do [Add a To-Do](#) »

Start date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D11 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Notifications ☒

Figure 82 AG.D11.FR.001. Include Policy making

AG.D11.FR.001-1. Connected to the agent-based simulation module via the external interface module

Description: The Policy making submodule must be connected to the agent-based simulation module via the external interface module.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date ? Edit

☐ Fixed: None

☒ Inherited: None

Labels Edit

module: D11 priority MH

status Approved tested No

type FR

Ancestors

AG.D11.FR.001. Include Policy making

Confidentiality Edit

☒ Not confidential

1 participant

Figure 83 AG.D11.FR.001-1. Connected to the agent-based simulation module via the external interface module

AG.D11.FR.001-2. Translate the policy schemes of interest into the AGRICORE simulation environment

Description: The Policy making submodule must be able to define a policy and translate it into an input for the simulation engine.

Requester	AAT & IDENER
Release	1.0

Edited 41 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date ? Edit

☐ Fixed: None

☒ Inherited: None

Labels Edit

module: D11 priority MH

status Approved tested No

type FR

Ancestors

AG.D11.FR.001. Include Policy making

Confidentiality Edit

☒ Not confidential

1 participant

Figure 84 AG.D11.FR.001-2. Translate the policy schemes of interest into the AGRICORE simulation environment

AG.D11.FR.001-3. Agents' model structures modification

Description: The Policy making submodule have to introduce the necessary modifications of the agents' model structures as a previous step to the agents' instantiation.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [? Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D11 priority MH

status Approved tested No

type FR

Ancestors

☒ AG.D11.FR.001. Include Policy making

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 85 AG.D11.FR.001-3. Agents' model structures modification

AG.D11.FR.001-4. Flexible definition of the support instruments

Description: The Policy making submodule have to enable the flexible definition of the support instruments, covering both, the ones used in Common Agricultural Policy (CAP) first pillars as well as the more targeted and potentially complex ones used for CAP second pillar and post-2020 policies.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [? Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D11 priority MH

status Approved tested No

type FR

Ancestors

☒ AG.D11.FR.001. Include Policy making

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 86 AG.D11.FR.001-4. Flexible definition of the support instruments

AG.D11.FR.002. Include Policy impact assessment

Description: The Policy environment module have to include the Policy impact assessment submodule.

Requester	AAT & IDENER
Release	1.0

Edited 58 seconds ago by Alberto Rojas

Epics and Issues Roadmap

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Add

AG.D11.FR.002-1. Connected to the agent-based simulation module via the external interface module

agricore&79

0

0

AG.D11.FR.002-2. Calculate main KPI's linked to specific agricultural policies

agricore&80

0

0

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D11 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Notifications ☒

Figure 87 AG.D11.FR.002. Include Policy impact assessment

AG.D11.FR.002-1. Connected to the agent-based simulation module via the external interface module

Description: The Policy impact assessment submodule must be connected to the agent-based simulation module via the external interface module.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

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Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D11 priority MH

status Approved tested No

type FR

Ancestors

AG.D11.FR.002. Include Policy impact assessment

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 88 AG.D11.FR.002-1. Connected to the agent-based simulation module via the external interface module

AG.D11.FR.002-2. Calculate main KPI's linked to specific agricultural policies

Description: The Policy impact assessment submodule must calculate the main KPI's linked to specific agricultural policies.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D11 priority MH

status Approved tested No

type FR

Ancestors

☒ AG.D11.FR.002. Include Policy impact assessment

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 89 AG.D11.FR.002-2. Calculate main KPI's linked to specific agricultural policies

D12: Agricore interface module

AG.D12.FR.001. Centralise the interaction of the users with the AGRICORE suite

Description: The Agricore interface module should centralise all the interaction of the users with the AGRICORE suite.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D12 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 90 AG.D12.FR.001. Centralise the interaction of the users with the AGRICORE suite

AG.D12.NFR.001. Developed as a cross-platform desktop application web technologies

Description: The Agricore interface module will be implemented as a cross-platform desktop application using web technologies. The application should be compatible with the Chrome web browser.

Requester	AAT & IDENER
Release	1.0

Edited 40 seconds ago by Alberto Rojas

Epics and Issues Roadmap

0 0 Add

Due date [Edit](#)

☐ Fixed: None

☒ Inherited: None

Labels [Edit](#)

module: D12 priority MH

status Approved tested No

type FR

Ancestors

None

Confidentiality [Edit](#)

☒ Not confidential

1 participant

Figure 91 AG.D12.FR.002. Developed as a cross-platform desktop application web technologies

References

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- 2) [^](https://gitlab.com/gitlab-org/gitlab) GitLab, “GitLab repository.” [Online]. Available: <https://gitlab.com/gitlab-org/gitlab>.
- 3) [^](https://docs.gitlab.com/ee/user/group/epics/) GitLab, “Epics.” [Online]. Available: <https://docs.gitlab.com/ee/user/group/epics/>.
- 4) [^](#) {"format":"ieee","bibTeXEntry":"","cacheKey":"18121401:8:gitlabtags:ieee:170"}
- 5) [^](https://www.agilebusiness.org/page/ProjectFramework_10_MoSCoWPrioritisation) A. business, “MoSCoW Prioritisation.” [Online]. Available: https://www.agilebusiness.org/page/ProjectFramework_10_MoSCoWPrioritisation.
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- 7) [^](#) I. T. 1975:2015, “Software Engineering — Guide to the software engineering body of knowledge (SWEBOK),” Oct. 2015.
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Apart from the references mentioned along the document, the current deliverable took into account following inputs:

- AGRICORE Proposal: project proposes a novel tool for improving the current capacity to model policies dealing with agriculture by taking advantage of the latest progresses in modelling approaches and ICT.
- AGRICORE Grant Agreement ANNEX 1 Part A and B, Research and Innovation action, Number-816078: Official Grant Agreement of the AGRICORE project, which defined the terms and conditions of the project, as well as the main requirements of the project.

Deliverable Number	Deliverable Title	Lead beneficiary	Type	Dissemination Level	Due date	Reason
D1.1	Standardised Methodology and Set of Ontologies for the Characterisation of the Data Source	UNIPR	Report	Public	M11	Gather requirements and specification for ARDIT
D6.6	"Software Quality Assurance measures for AGRICORE"	AAT	Report	Public	M15	Understand the content to avoid overlapping with this D4.1

