SoilWise

KNOWLEDGE & DATA FLOWS

D1.1 Usage scenarios, requirements, v1.0

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Abstract	The purpose of this deliverable is to describe the methodology of co-creation and definition of the user needs, expected usage scenarios for the architectural design, requirements, and validation framework through user stories to facilitate the co-design of the repository. This document also defines the methodology from user stories to requirements and the insights obtained in that process.

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List of Abbreviations

BIOS	BIOSENSE INSTITUTE - RESEARCH AND DEVELOPMENT INSTITUTE FOR INFORMATION TECHNOLOGIES IN BIOSYSTEMS
CORDIS	Community Research and Development Information Service
CREA	CONSIGLIO PER LA RICERCA IN AGRICOLTURA E L'ANALISI DELL'ECONOMIA AGRARIA
DoD	Definition of Done
ELO	European Landowners Organization
ESDAC	European Soil Data Centre
EV ILVO	EIGEN VERMOGEN VAN HET INSTITUUT VOOR LANDBOUW- EN VISSERIJONDERZOEK
EUSO	EU Soil Observatory
GAIA	GAIA EPICHEIREIN ANONYMI ETAIREIA PSIFIAKON YPIRESION
i.c.w.	In connection with
INRAE	INSTITUT NATIONAL DE RECHERCHE POUR L'AGRICULTURE, L'ALIMENTATION ET L'ENVIRONNEMENT
ISRIC	STICHTING INTERNATIONAL SOIL REFERENCE AND INFORMATION CENTRE
JRC	European Commission's Joint Research Centre
LTE	Long Term Field Experiment
KPI	Key Performance Indicator
MRV	Monitoring, Reporting, and Verification
MU	Masarykova univerzita

MVP	Minimum viable product
NP	NEUROPUBLIC AE PLIROFORIKIS & EPIKOINONION
PC	Project Coordinator
PTF	Pedotransfer function
PU	Public
REA	European Research Executive Agency
R&I	Research and Innovation
SC	Scientific Coordinator
SWR	SoilWise Repository
TX.Y	Task, X= number of work package, Y= number of the task
TBA	To be added (in the next iteration)
TM	Technical Manager
UC	Use Case
US	User Story
VL O	Vlaamse Gewest
WE	WETRANSFORM GMBH
WP	Work package
WR	STICHTING WAGENINGEN RESEARCH
ZALF	LEIBNIZ-ZENTRUM FUER AGRARLANDSCHAFTSFORSCHUNG

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1 Introduction

1.1 Project summary

Now more than ever, soil health is an issue that needs to be addressed urgently, as recent assessments state that 60-70% of European soils can be considered unhealthy (Bouman, 2022). The EU Mission 'A Soil Deal for Europe', the EU Soil Strategy and the proposal for a Soil Monitoring and Resilience Directive (5 July 2023), aims to have 75% of EU soils healthy or significantly improved by 2030 and all soils healthy in 2050 (Panagos et al. 2022). Reaching such an ambition requires, among others, access to reliable, harmonised existing and new data and knowledge collected at local, national and EU levels to allow **informed decision-making at all scales to support the proposed Soil Monitoring and Resilience Directive and the EU Soil Strategy**.

The SoilWise project will provide an integrated and actionable access point to scattered and heterogeneous soil data and knowledge in Europe, making them FAIR (Findable, Accessible, Interoperable and Reusable) (Wilkinson, et al. 2016) and improve trust, willingness, and ability to share and re-use soil data and knowledge. In three project development cycles, **co-creation and co-validation by multi-stakeholder groups are at the centre of project activities**. SoilWise recognises existing workflows and repositories for specific user needs and aims to work with them to enhance their discoverability, approachability, and interconnection. An overview of existing repositories foreseen for data integration with SoilWise is schematised in figure 1. We also foresee visualisation by multiple coordinated views approach, as discussed, e.g. by Langner et al. (2018). An open, modular, scalable, and extensible knowledge and data repository building on existing and new technologies will be provided while respecting data ownership, access policies and privacy. AI- and ML- techniques will be employed to interlink scattered data and knowledge, automatise the processes, infer new knowledge and increase FAIRness. **SoilWise applies infrastructure thinking instead of project thinking to design a repository for at least a decade to support EUSO evolvement accordingly**. The SoilWise Repository (SWR) and community are designed to be a joint starting point and common ground for countries, the European Commission, and other stakeholders to jointly guide soil and related spatial policy and informed decision-making towards the 2030 goals of the Green Deal (Montaldo, S. 2022), achieve healthy soils in 2050 and ensure broad uptake and implementation by land managers, policy, research, and industry.

All personal data acquired through SoilWise is processed in strict accordance with the relevant EU privacy regulations, highlighting our dedication to uphold to the highest standards of data privacy and security for our users.

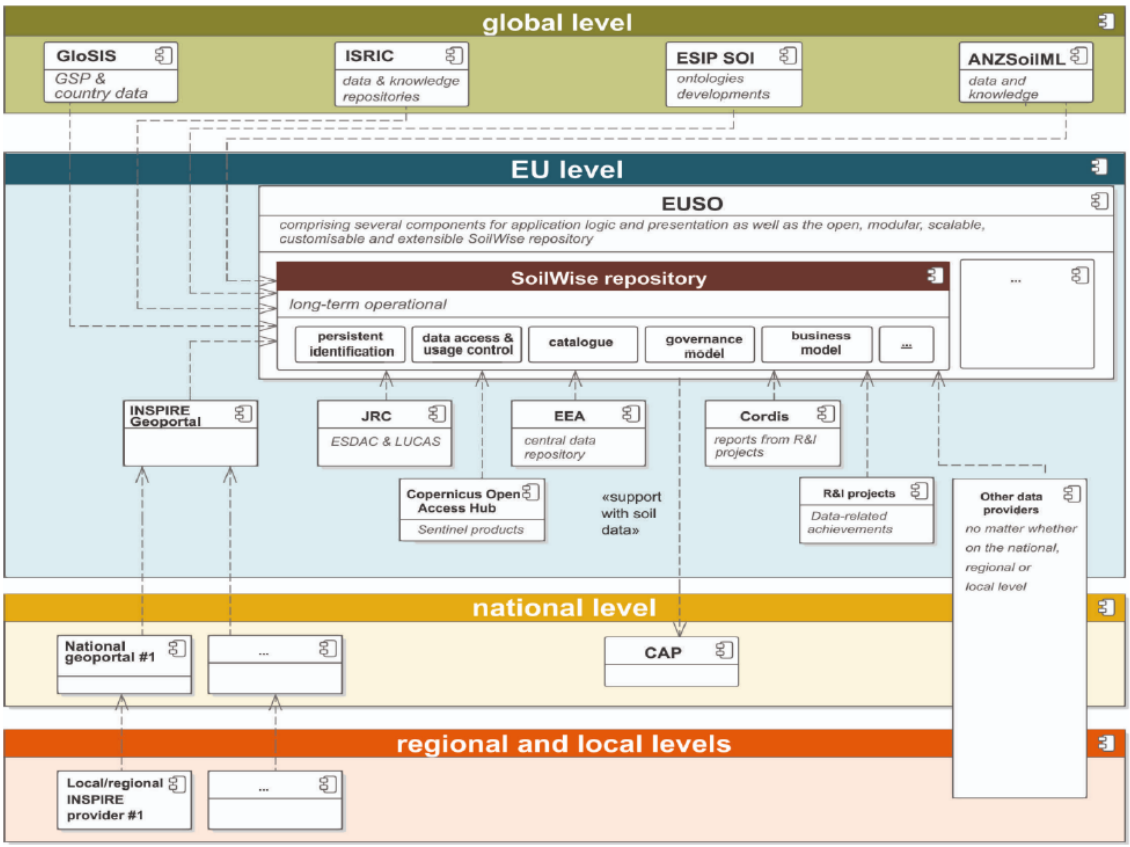

Figure 1 A schematized overview of data and knowledge flows between the SoilWise Repository and other repositories.

1.2 WP1 objectives and relevant tasks

WP1 objective is to co-design (Phase 1) together with user case actors, JRC and EUSO, the T6.2 identified stakeholders, and the WP2-3-4, the building blocks of the SoilWise Repository. Specific objectives are:

i) gather, synthesize, and deliver the needed user input to support the design and development of the repository;
ii) deliver a high level prototype architecture of SoilWise;
iii) deliver innovative governance models that support the development of trusted and interoperable data spaces for data and knowledge exchange on soil domains;
iv) manage the project rolling plan activities for adaptation.

The tasks from 'WP1 - Co-design a user driven SoilWise Repository' have interdependencies between them and with the tasks from the other work packages which showcase the need for close collaboration and coordination between the responsible partners for the successful implementation of the project as shown in figure 2 .

T1.1 is defining the repository usage scenarios by analysing existing data workflows and engaging stakeholders from the SoilWise evolving network (T6.2) and thus feeding to the architecture design of the platform (T1.4). This task also contributes to the development of the multi-stakeholder governance model (T1.5), which will be

described in deliverable D1.5. In the same way, T1.2 sets the framework of the JRC and EUSO cooperation, facilitated by the project coordinator (T7.2), shaping the governance model and technical aspects, and influencing the architecture design (T1.4 - not in the scope of this deliverable). The design of the SoilWise Repository is setting the work of the WP2, WP3 and WP4 which are effectively building the repository. Moreover, the T1.3, focused on stakeholder requirements, validation framework and rolling plans, is integral to T4.3 and T5.3, validation, and evaluation of the platform with the users, respectively. T1.3 extracts requirements which are critical for the architecture design (T1.4).

This dynamic ensures a cohesive project implementation with each task highlighting the collaboration efforts necessary to reach the objectives of SoilWise.

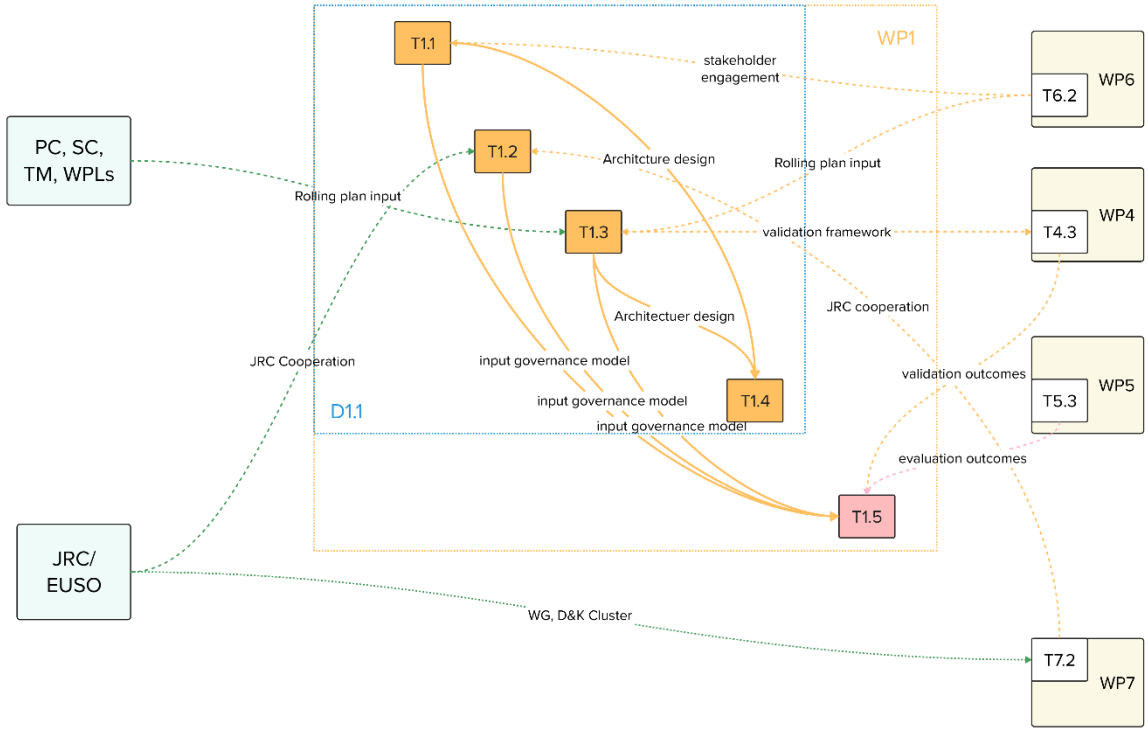

Figure 2 SoilWise WP1 Task Dependencies

1.3 Document scope

This deliverable describes the methodology used and the results achieved in generating requirements, validation framework and the rolling plan during the first iteration of the co-design process. This fits with one of the work package (WP) 1 goals to gather, synthesize and deliver the needed user input to support the design and development of the repository in iterative cycles.

This deliverable is the first version of two deliverables. At the start of each iteration of the development of the SoilWise Repository, the users will be consulted and at the start of the third cycle, the results will be used to update the requirements and description of user needs in D1.2 (M36).

1.4 Document structure

This document is comprised of the following chapters:

- **Chapter 1** presents an introduction to the project and the document
- **Chapter 2** provides the terminology used in the document
- **Chapter 3** describes the methodology from user needs to requirements
- **Chapter 4** contains the repository usage scenarios
- **Chapter 5** presents the approach to extracting technical components and requirements
- **Chapter 6** describes the cooperation with JRC and EUSO
- **Chapter 7** describes the methodology of the validation framework
- **Chapter 8** presents the rolling plan

1.5 Relationship to other project deliverables

This deliverable relates to and complements the following deliverables:

- **D1.2** - Usage Scenarios, Requirements, v2 (M36)
- **D1.3, D1.4** – Repository architecture, v1, v2 (M8, M42)
- **D1.5, D1.6** – Repository GM, v1, v2 (M21, M42)
- **D5.1, D5.2** - Use cases guidelines and demonstration plans, v1, v2 (M12, M24)
- **D5.6** – Usage best practices and replication guidelines (M47)
- **D6.2, D6.3, D6.4** – DEC and Capacity Building Plan and Report v1, v2, v3 (M3, M18, M48)

2 Terminology

This chapter provides an overview and explanation of the terminology used throughout the document. The alignment between terms is shown in figure 3. The (work)flow starts at each iteration with use cases for which user story epics are derived, which are narratives that are subsequently narrowed down and translated into user stories/requirements. These requirements feed into the ongoing development process with associated acceptance criteria and are administered in the backlog, while the wider process is governed in the validation framework. Technical components and functionalities are extracted from user stories, thus shaping the development of the SoilWise Repository. During the development phase in each iteration, which is organised in sprints, the priority of tasks is defined in the sprint backlog. During iterations, new developments are tracked in the rolling plan, to be considered at the next suitable moment in the iteration cycle.

Box 1 Terminology

The **SoilWise use cases** are described in the Grant Agreement to understand the needs from the stakeholder groups (users). Each use case provides user stories epics.

A User story epic is a narrative of stakeholders needs that can be narrowed down into smaller specific needs (user stories/requirements).

A **User story** is a statement, written from the point of view of the user, that describes the functionality needed by the user from the SoilWise Repository.

Requirements are the capabilities of an envisioned component of the repository which are classified as 'must have', or 'nice to have'.

Both user stories and requirements are extracted from the user story epics, and, in this report, will be used together as user story/requirement as both are still under development.

User stories/requirements have **acceptance criteria** which can be used to judge if the resulting software satisfies the user needs. A single user story/requirement can have multiple acceptance criteria.

From the user story epic and the user story/requirement, **technical components** and **functionalities** can be extracted. Technical components correspond to the modular parts of the SoilWise Repository, which encapsulate and provide the functionalities of the SoilWise Repository through interfaces to the user and other systems.

Several user stories can be clustered in one or more **usage scenarios**, which describe how (groups of) users might use the software product. These usage scenarios can originate or be updated from the SoilWise use cases, user story epic or user stories/requirements.

A **validation framework** is a framework allowing good communication between users and developers, validation of developed products by users, and flexibility on the developer's side to take change requests into account as soon as possible. The validation framework needs a description of the functionalities to be developed (user stories/requirements),

the criteria that enable to verify that the developed component corresponds to the user needs (acceptance criteria), the definition of tasks for the developers (backlog) and the workflow.

An **iteration** is each development cycle (3 in this project) in the project. Each iteration can have **phases**. There are four phases per iteration focussing on co-design, development, integration and validation, demonstration.

The **product backlog** is the document where user stories/requirements are gathered with their acceptance criteria, and prioritized.

A **sprint** is a small timeframe during which tasks have been defined.

A **sprint backlog** is composed of the set of product backlog elements chosen for the sprint, and an action plan for achieving them.

A **task** is the smallest segment of work that must be done to complete a user story/requirement.

A **rolling plan** is a methodology for considering the internal and external developments that may generate changes to the SoilWise Repository design and development. It keeps track of any developments and changes on a technical, stakeholder group level or at EUSO/JRC.

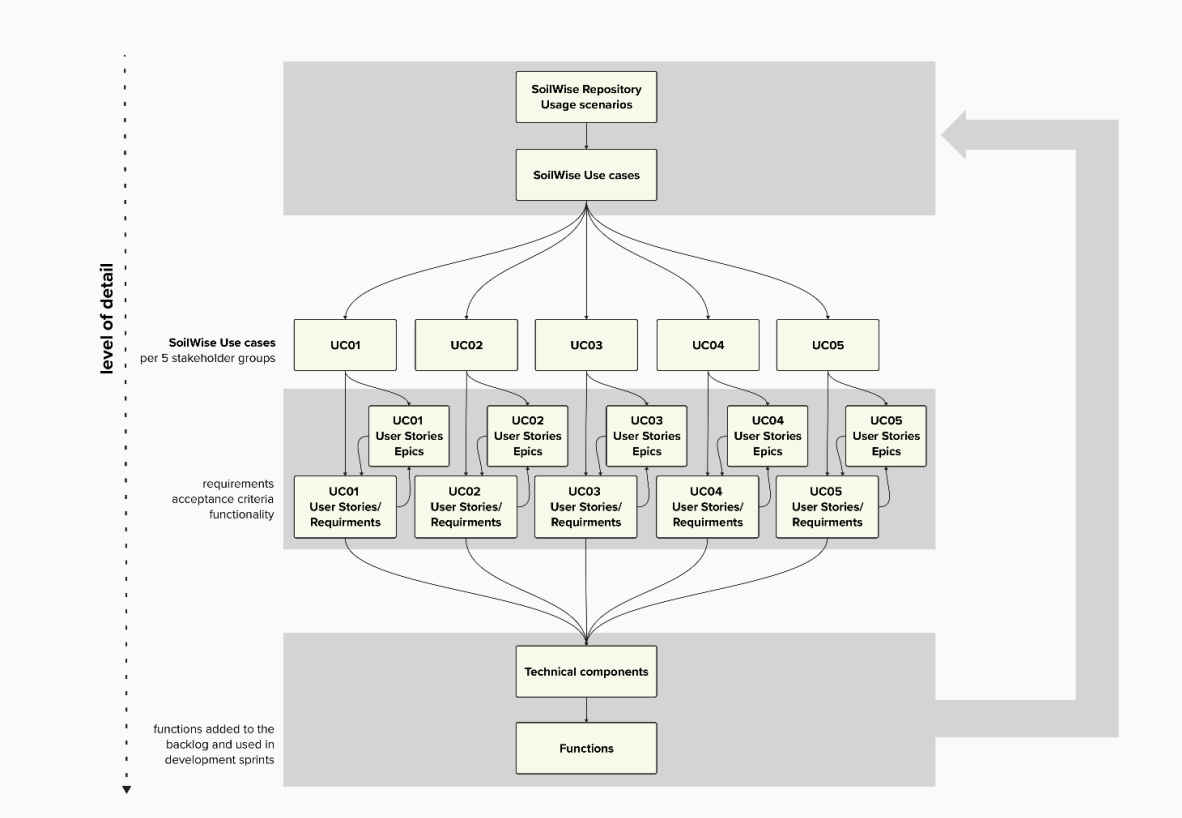

Figure 3 Graphical overview of relationships between Use Cases, user stories and alignment towards desired repository functionality

3 Methodology

3.1 General methodology

User needs reflect the expectations of users of the added value and way of interaction they expect from a product, in our case the repository. They are likely to be different for different types of users or stakeholders. For example between users or producers/providers of data and knowledge and for the different stakeholders groups such as researchers, policy makers, land managers, authorities, businesses, etc. Elicitation and user centred design and development, when backed with solid technical evaluation of possibilities, make sure the final product, the prototype of the SoilWise Repository, is a system that helps users in one way or another and therefore is used. User needs are crucial for a successful repository development and operation.

User needs elicitation is the practice of researching and discovering the requirements of a system from users, customers, and other stakeholders (Sommerville, 1997). Or, in other words, the process of defining user needs together with the users in a co-creation process.

The SoilWise project considers user needs elicitation and validation as a central aspect and as a process that needs to be iterative in the software development foreseen in the project. This is important on one hand as the user needs might change over time, and on the other hand because evaluations of a first version of a prototype by users, typically sparks new ideas and insights. The SoilWise Repository will require renewed evaluation by users to its suitability of use for their applications. This process is emphasised and reflected in the project iteration cycles in figure 4.

Figure 4 Description of the SoilWise development cycles.
Source: SoilWise Grant Agreement (101112838).

There are several ways in which user needs can be collected, collated, refined, evaluated, formalised, validated and updated. The user-needs elicitation itself can include surveys, workshops, structured interviews, non-structured interviews, collection of results of other existing user needs assessments for a similar product with a similar stakeholder group, deduction from (grey) literature and organisational websites and conference presentations. The core is an open interaction with the users. Once the users have been identified and engaged

(figure 5), their needs can be assessed by any of the interaction methods described before. The user needs are described in user story epics that are narrowed down to user stories or requirements that are usually more specific and singular (see chapter 2 for the definitions and chapter 5 for examples). The extracted requirements are then validated with the users (e.g. researchers, policy makers, etc., see chapter 3.1.1), to verify if they indeed represent their needs and would meet the way they would like to interact with the repository or software. The requirements and acceptance criteria guide the technical development work and are a means of communication between the user and the software developer during the development process. Keeping track of the requirements throughout the process also allows to evaluate if the initial requirements are met in the final solution that is delivered. This sequence of activities usually follows the flow shown in figure 5.

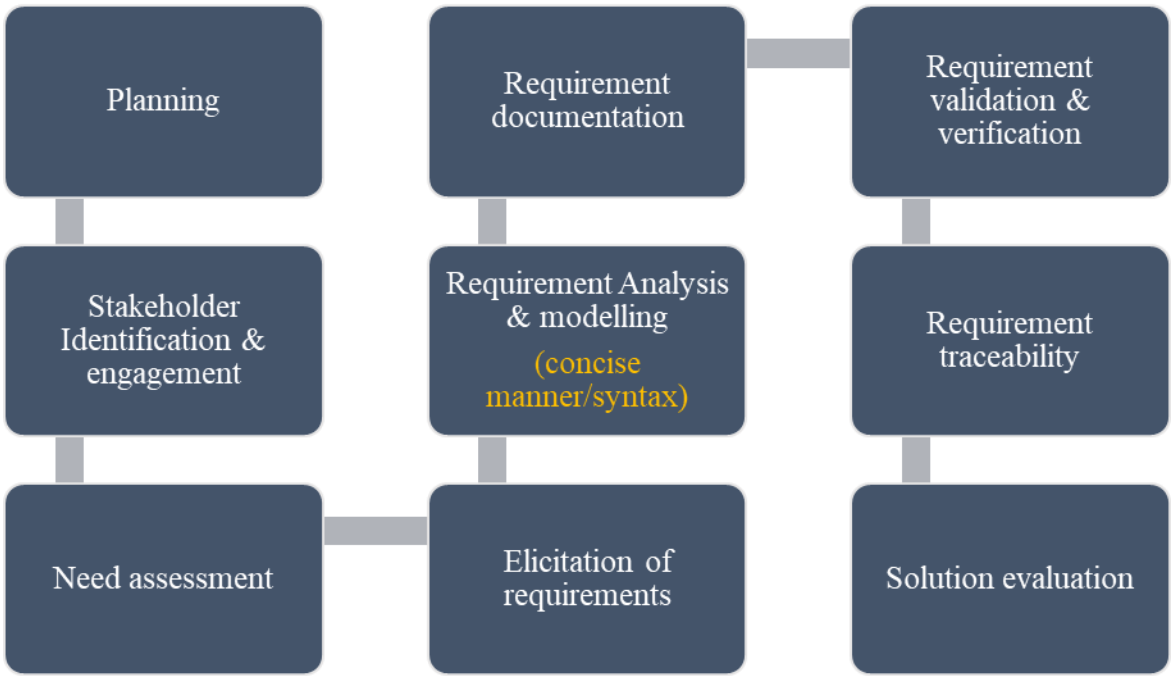

Figure 5 sequence of activities during co-design process

3.1.1 Implementation of general methodology in the SoilWise project

In the call for proposals (HORIZON-MISS-2022-SOIL-01-01 Building the mission's knowledge repository and advancing the European Soil Observatory) that SoilWise responded to, several stakeholder groups were identified. These were leading for choosing the stakeholder group categorisation that was chosen in the proposal:

- Land managers (including farmers),
- Policy makers and Authorities,
- Scientific community/ researchers,
- Financial/Business and Industry partners,

- R&I Networks,
- General audience (consumers, students).

During consortium formation, these groups were one of the aspects determining the composition of the consortium, ensuring a reasonable representation from all stakeholder groups. In elicitation with the foreseen WP lead and (these) partners, use cases were developed that represent the main usage scenarios per stakeholder group, based on partners' experience in the domain. These SoilWise use cases are the starting point of the user co-creation and elicitation process in this project and deliverable.

At the start of the project, the usage scenarios and user or stakeholder groups defined in the proposal, together with the requirements of EUSO/JRC are extended, validated, and elaborated into user story epics, user stories/requirements, and acceptance criteria. First, by the relevant partners in the consortium, later also through wider stakeholder consultations (i.c.w. T6.2 Fostering network of relevant projects, initiatives, and institutions). The SoilWise use cases and the possible usage scenarios in the stakeholder groups can be described by a wide range of user stories. The first step must ensure that a reasonable coverage of the SoilWise use case and stakeholder needs is covered by the user story epics. The collected user story epics will be validated in consultation with the wider stakeholder groups together with T6.2. This will be done through specified workshops organised by SoilWise (at least one per iteration), by taking part in workshops or conferences organised by the stakeholder group or by surveys (at least one per iteration).

The user story epics, user stories/requirements and acceptance criteria inform the (first) design of the architecture of the SoilWise Repository (T1.3) and provide a thorough and validated overview of user (both users and providers of data and knowledge) needs and how they would like to interact with the SoilWise Repository. This overview is crucial in developing a business and governance model for the SoilWise Repository after the project ends. It informs other initiatives on soil data and knowledge sharing, and can support interaction and engagement with stakeholders. New user story epics are written continuously during the project, and in every iteration cycle these new user story epics are validated by the use cases but also by the wider stakeholder consultations. After validation, they are added to the total body of user story epics and as such enter in the process described below.

Once the user stories/requirements and acceptance criteria are defined, a first selection is made of the most relevant user stories per stakeholder group, considering the aim of the SoilWise Repository (Building the mission's knowledge repository and advancing the European Soil Observatory). Subsequently, the technical components or modules are identified that will be needed to fulfil the selected user stories, specified further to functions the repository should be able to perform. In the first iteration cycle (M1-21) this result, together with considerations like the availability of components, effort needed to create them, value to the repository etc., defines the core technical components and functionalities of the repository, that will form the minimum viable product (MVP). In the second (M22-34) and third (M35-46) iterations, this results in identifying additional technical components, or functionalities, that needs to be added to the MVP to fulfil the newly prioritised set of user stories. The acceptance criteria are the metrics with which the functions can be evaluated later. The user stories/requirements and acceptance criteria are entered in the product backlog. This process is visualised in figure 6.

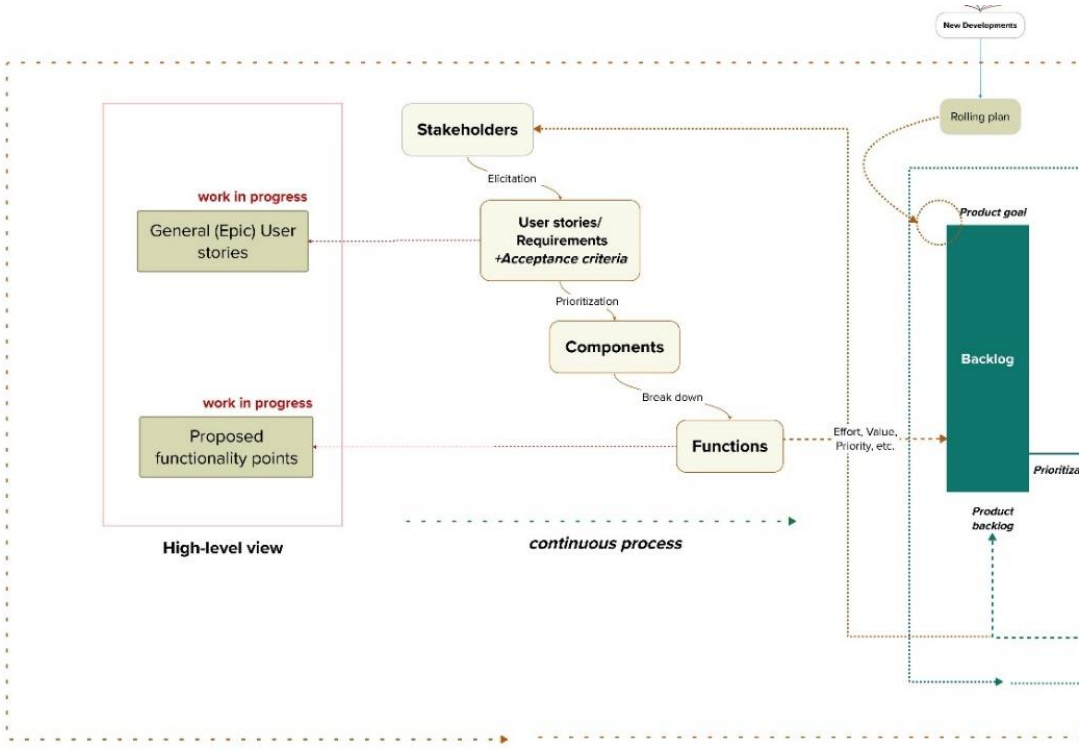

Figure 6 Schematic overview of the project cycle

Note that this process stays on a functional level. Decisions on which (existing) software and standards to use, how to design and construct the repository itself are taken during the architectural design of the repository. This will be described in D1.3 Repository architecture (M8).

Although the user-needs elicitation process will be a continuous process, with the possibility to add new user story epics to the existing set at any time, the inclusion of new (prioritised) user stories/requirements, prioritisation, etc. will only take place once every iteration cycle. To keep track of any developments and changes on a technical, stakeholder group level or at EUSO/JRC that should be considered in the next iteration of the repository, a rolling plan will be developed and maintained. This is elaborated in chapter 8.

3.2 First iteration

3.2.1 Adaptation to the original plan

The general methodology described in chapter 3.1 is the starting point and main process of the user needs elicitation in the SoilWise project. It was decided however, to allocate more effort in the first four months of the project to homogenise the terminology used in the project by soil and data scientists, elaborate a thorough set of user story epics, create a mock-up or first demonstrator version of the repository, inventory the wider stakeholder group to be consulted and engaged, and collaborate with key partners JRC/EUSO and the Mission Soil Cluster on Data and Knowledge Management on engagement of the Mission Soil research projects. By making sure these building blocks are in place, the usefulness and effectiveness of the stakeholder validation was increased, while not delaying the other activities in the project such as the architectural design of the repository and the development work.

3.2.2 Activities performed

Together with T6.2, a Stakeholder Mapping Template was made, and all partners were requested to fill in the stakeholders that they know and consider relevant to the project, to be able to approach them for the stakeholder consultation of user needs. This resulted in 86 listed stakeholders of all stakeholder groups, without counting the connection that ELO provided and not yet including the full list of Soil Mission projects. These are known but still need to be added in the second iteration. Here, also collaboration with the Mission Implementation Platform Clusters is foreseen, specifically the Cluster on Data and Knowledge Management, possibly also the Cluster on Stakeholder Communication.

During the kick-off meeting in September 2023, a dedicated session was held to elicit requirements and user story epics that partners have in mind for the SoilWise Repository, with their knowledge of user needs of the stakeholder groups they are part of. This yielded a rich collection of aspects and in some cases user story epics that can be considered.

At the kick-off meeting, a first inventory of existing user needs assessments was made that could be informative and useful towards the expectations and needs for the SoilWise Repository. The list is provided below. Documents are being collected in the shared consortium folder.

- ESA WorldSoils / CUP4Soil: remote sensing for soil
- ScaleAgData - 1st iteration done
- ENVISION
- EJP SOIL
- Network of geo-ecology LL, research infrastructure, enviro-agronomics
- PrepSoil
- Natioons
- GLOSOLAN - spectroscopy
- Who needs which soil data - demo survey for SIS
- BENCHMARKS
- Upcoming LL calls?
- ORCaSa
- SMS project
- SOLO (December meeting in Barcelona)
- AgriDataSpace
- GREAT use case for soil
- DOV user workshops
- Longterm vision 2008: DOV_behoeftenanalyse_bodemdatabank_2008
- Longterm vision 2018: Visie DOV 2023
- Study: translating soil information to the user's needs (Dutch, still running until mid-summer 2024, is looking in-depth at cases dealing with citizens, spatial planning and permitting, garden architects, landscape architects).
- Questionnaire on soil pollution (Dutch, SoilWise is asking permission to distribute this)
- Soil data per geometry needed for Forestry Decision Support System

User story epics and user stories/requirements help describe, understand, and concretise the user needs for the repository, and can later be used to test whether the repository serves the needs of the users. To facilitate their creation, a template for a user story was set up and first examples were made during elicitation meetings with SoilWise use case leads (see annex I). The aim was to come to a common understanding of what a user story is, what it should contain, what it does not need to contain, how elaborated or detailed it should be, in which way and how it can use this to communicate user needs, interactions of users with the repository and potential data or knowledge flows through the repository between the partners with different backgrounds and roles in the project. During the process of describing the user stories as part of the user needs elicitation process in the first iteration, it turned out that the written user stories were too broad to be classified as user stories and were classified as user story epics. The more detailed user stories will be extracted from the created user story epics. The template is shown in annex I.

Effective communication between different individuals, including users, domain experts and the technical team, becomes critical when creating user story epics. Their collaborative insights ensure the practicality of desired features and bridge the gap between user expectations and technical constraints. This collaborative approach not only improves the clarity and user-centricity of the user story epics, but also contributes to the overall success of the project. Therefore, another choice was to involve not just the T1.1 leads, and SoilWise use case leads in the process, but also the WP5 lead, the T1.4 lead, the project manager and the WP4 lead. This increased the group size and effort but also the created understanding, allowed different expertise and viewpoints to be heard and synthesized and was generally considered to be of added value to the quality of the result and the process. Subsequently, two to three series of meetings were organised with this group, per SoilWise use case. SoilWise use case leaders and afore mentioned partners participating in the meetings were asked to write first drafts of user story epics that cover (most of) the scope of the SoilWise use cases, including user story epics that address the requirements expressed by EUSO/JRC. During the meetings these first drafts were discussed and improved, elicited from different viewpoints, ensuring a sufficient level of detail, and understanding of everyone involved. The focus of several user story epics was adjusted to ensure fuller coverage of the SoilWise use case (and therefore stakeholder group) needs and description. Nonetheless, when several user story epics described the same technical functionality but with different aspects, these were maintained. Many user story epics have been elaborated to a sufficient level, but about one third of the user story epics are at present only shortly described and will be elaborated further in the coming months. This is a continuous process. So far, 64 user story epics have been created.

With 64 user story epics divided over the five SoilWise use cases or stakeholder groups, a selection of user story epics had to be performed to provide the most relevant, concrete, and usable user story epics to T1.4 to provide user input to the first version of the architectural design of the repository (D1.3). The SoilWise use case leaders were asked to rank the user story epics which they consider elaborated enough and most relevant to their stakeholder group and SoilWise use case. This resulted in a short list of up to 5 user story epics per SoilWise use case. During this cycle, the user story epics will be further elaborated and re-evaluated before the next iteration.

Another scoring of the user story epics was made based on the requirements by EUSO/JRC as it was currently interpreted. This resulted in a ranking of user story epics according to relevance to EUSO/JRC. In parallel, the T1.4 and WP4 leaders extracted from all elaborated user story epics the technical components that they consider to be needed in the SoilWise Repository to fulfil the user story epic. This list was then inverted to allow sorting on the frequency of occurrence of technical components in user story epics, while maintaining the link which technical component occurs in which user story epics.

The selection of user story epics by SoilWise use case leaders, the ranking according to EUSO/JRC relevance and the occurrence of technical components were combined during a live meeting on 19 January 2024, in Heerlen, The Netherlands. The result was that almost all the 34 identified components (incl. 15 on integration with different repositories or endpoints) were present in the selection of 15 most important user story epics from the use case leaders and EUSO/JRC perspective. The selection of technical components for the first prototype version of the SoilWise Repository in the first iteration is continued in the process towards the architectural design (D1.3). The prioritisation of user story epics from the users point of view will be included in this process.

The next step is the extraction of more specific or crisp user stories/requirements from the larger user story epics considered so far and extracting the acceptance criteria of the selected user stories. These next steps are carried out in T1.3. The lists of selected and associated user story epics and their acceptance criteria are provided to T1.4 and described in the subsequent chapter and D1.3. In April 2024, a next round of meetings with use case leaders is already planned to validate the process of technical components extraction. An in-person evaluation meeting is scheduled to learn together from the process so far, design improvements and schedule the remaining work on user needs elicitation for this iteration and the next.

3.3 Next cycle co-design planning

The process of user story epics elicitation, validation and refinement will continue during the current iteration. First with an elaboration of the current user story epics, followed by a stakeholder validation exercise, including at least one workshop and survey, likely added by stakeholder group specific activities (see chapter 3.1). At the start of every iteration, the list of user story epics is ranked on importance for the use case by the use case leads in consultation with the use case participants, based on the input from the stakeholder validations. The importance of specific user story epics for a use case can change in each iteration cycle. This can for instance be due to achieved functionality, which allows for focussing on the next needed functionality, and changing needs of the user group. The process of ranking of the user story epics to prioritise the work in the next development cycle is a combination of assessment of business value, feasibility, and availability of resources. It therefore includes the ranking of the use case leads and stakeholder validation, but also includes technical aspects, like feasibility and resources needed. As such, also the WP leads, and other project partners are involved in the prioritisation. For this purpose, a multi-criteria assessment for prioritisation will be elaborated in 2024, which will be updated during the project when needed, including all aspects mentioned above. The four aspects of business value we identify within SoilWise are:

- value for the end users;
- fulfil requirements as specified in the Grant Agreement;
- novel academic insights;
- value for the participating partners and stakeholders (JRC).

For the SoilWise use case on research, it was decided to select for the first iteration only user story epics involving EU soil research projects that started before May 2023, to ensure they have evolved their data management enough and are likely to have products to evaluate, to be tested in September 2024. User needs from EU research projects starting after May 2023 are engaged through the Mission Soil Cluster on Data and Knowledge Management and described in user story epics. They will be considered in the selection for testing of user stories only for the second and third iteration.

4 Repository usage scenarios

4.1 Introduction

Following the quadruple helix framework (Carayannis & Campbell, 2010), SoilWise is driven by an evolutionary, agile, well-delineated and lean approach, which incorporates an open-innovation, co-creation, multi-stakeholder, and problem-solving approach. This includes stakeholder mapping, the understanding of the end-user needs including the identification and elaboration on SoilWise Repository outcomes to different stakeholders. It follows a dedicated co-creation approach that will bring together regional stakeholders, technology experts, policymakers, governmental actors and academics from different disciplines and innovative service providers to contribute jointly to identifying specific innovation needs.

Understanding user needs are important for the development of the SoilWise Repository. One of the goals of SoilWise is to provide a stakeholder-driven functionality in line with use cases, addressing both data/knowledge (re)user and a data/knowledge provider perspective. A means to get there is by describing user story epics for each use case. This chapter describes the process and provides a summary of the user story epics.

4.2 SoilWise Use Cases and stakeholder groups

Several key users are identified as a stakeholder group for each use case to detail the different use cases as highlighted in the grant agreement. The SoilWise use cases are further specified and amended with the stakeholder groups during three project iteration cycles. The following five use cases are described in the grant agreement:

1. Soil health performance indicators for **Land Managers** (**WR** – ELO, EV ILVO);
2. Leveraging a network of Soil R&I Knowledge and Data to facilitate **scientists** (researchers) (CIRAD – INRAE, ISRIC);
3. Facilitate **policy makers** in policy Making & Evaluation to safeguard soil (CREA – VL O, ISRIC, JRC);
4. Enhanced capacities of **Public Authorities** and **Living Labs** actors (VL O - ZALF, EV ILVO);
5. New products, technologies, and services for **business** (Gaia – WE, ELO, BIOS, NP).

The five use cases link directly to the relevant stakeholder groups, test the functionalities and the added value of the SoilWise Repository to their solution and the other way around within SoilWise project. An approach of describing several user story epics within a use case is used to further specify the use cases. The user story epics are identified and described in interactive sessions with the stakeholder groups.

4.3 User story epics

During the first iteration cycle, user story epics were developed with the SoilWise use case leaders, the technical team and WP1 team members. More information about this process can be found in chapter 3.2. At the moment of writing, 64 user story epics are identified as shown in figure 7. Please note that the list of user story epics is subjected to change. Since this is the beginning of an iterative process, significant changes in the list of user story

epics are expected, as completely new ones may be developed during the stakeholder elicitation process, and some may disappear or will be merged with existing ones after consideration from the business analysis perspective. Most SoilWise use cases have currently a reasonable coverage in user story epics mapped to the specific aims of the SoilWise use case.

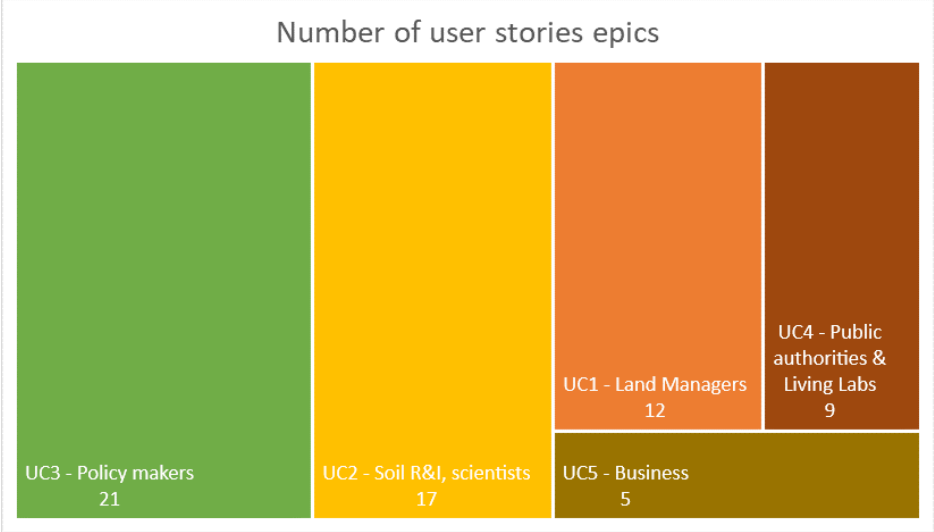

Figure 7 Overview of the current numbers of user story epics defined per SoilWise use cases.

4.3.1 Use case 1: Land managers

SoilWise use case 1 focuses on soil health performance indicators for land managers led by WR. Increasing soil health is an important aspect to land managers. High soil health may improve yield, increase the economic value of the land, and lower the risks of fines. Land managers and other actors can take more informed soil management decisions and have improved access to knowledge on soils, indicators of soil health and land degradation as well as solutions and land management advice to improve the status of soils. Data producers (farmers, industry, retail, government, academia) trust the infrastructure to only share the data with selected stakeholders for a limited period and may be more willing to share data to those stakeholders with improved consent mechanisms, which SoilWise aims to interlink. Table 1 presents an overview of the current list of user story epics defined for this SoilWise use case.

Table 1 List of user story epics defined per UC1 Land Managers stakeholder group

User story epic title	User role	Key user needs
Agro-environment aware farmer – data focused	Data user	Assess farm performance and progress on soil organic carbon Compare soil measurements with benchmark data See the criteria used to generate benchmark values
Agro-environment aware farmer – knowledge focused	Knowledge user	Get advice incl. motivation on combination of measures to increase soil organic matter content Interact with a chatbot

Agro-environment aware farmer – data provision	Data provider	Upload agronomic data and receive input on measures that work for my farm in improving soil organic matter content
1100 ha Regenerative Agriculture (reg-ag) Farm in South of Spain	Data user & data provider	maps of my 1100ha farm with information about soil erosion, soil organic carbon, vegetation types, overlapped with altitude maps and below groundwater (past, current state. and predictions) Help to develop a data-based farm management strategy Compare with other regions with similar crops and soil parameters
Bosgroepen Netherlands	Data user & data provider	Get guidance on how to adopt a system/approach to combine vegetation data and soil data
ELO Landowner	Data & knowledge provider and user	enter and retrieve soil data quickly and user-friendly facility to allow third parties to use this data retrieve information on paper enter the data in my native language Get advice and information on best practices needed to improve soil characteristics Have access to data from other landowners
ELO Farmer	Data & knowledge provider and user	Same as ELO Landowner Information on available subsidies and certifications Easy access to the required soil data needed for these subsidies and certifications through a user-friendly tool Format uploaded data to meet the criteria of these subsidies and certifications, including conversion to the appropriate units of measurement Retain ownership of my data and I intend to share it with selected individuals or entities only when necessary
ELO Land manager	Data & knowledge provider and user	Same as ELO Farmer
Farm Management System Developer	Data user	Support in creation of composite map with consistent data across countries Automated updates
Earthwatch – Soil Health Tool Kit	Data user	Seamless integration of data Mechanisms to validate data quality
Wijland	Data user	Seamless integration of data Efficient data access Data validation Alignment with existing data Extrapolate data Ability to integrate ML
Precision farmer	Data provider, Data & knowledge user	Data ecosystem where data can be easily and safely shared to monitor environmental performance on a regional level Data stored in a dynamic and interoperable format Automate data recording, communication, and processing effective and user-friendly data visualisation tools (trend analysis, comparison charts, and region-specific environmental performance indicators) benchmarking against regional and industry standards Data Compliance features Support evidence-based farming Access to knowledge resources, technical innovations, and practical demonstrations

4.3.2 Use case 2: researchers

SoilWise use case 2 is led by CIRAD and focuses on past, ongoing, and future Soil Mission Horizon Europe projects, scientists and researchers. Within Research and Innovation (R&I) projects, networks, knowledge, and data repositories are established and cultivated to cater to specific user groups, tailoring functionality and content to suit their needs. However, these repositories are typically isolated and not interconnected, resembling islands in the broader landscape. This results in a growingly intricate environment of scattered data and knowledge locations for users, leading to duplicated efforts in developing functionality and content. Once a project concludes, these repositories, along with their associated knowledge and data, often become challenging to locate or access, lacking persistence in availability. The adoption of project results in the knowledge cloud is of major interest to science and JRC, to prevent duplication of efforts and loss of knowledge over time. REA provides guidance on how to archive and report project deliverables and data generated in the projects. This will be described in the Data Management Plan (DMP) of the project. REA asks projects to create a Data Management Plan including a section on archiving. Persistence of project results after project termination however remains challenging due to multiple issues (e.g. lack of funding, awareness, capacity). In this context, SoilWise is expected to advertise best practices and tools for archiving project results, as well as serving as an intermediary platform, which will ensure their findability. Table 2 presents an overview of the current list of user story epics defined for this SoilWise use case.

Table 2 List of user story epics defined per UC2 Soil R&I Knowledge and Data stakeholder group

User story epic title	User role	Key user needs
ENVISION - data for Machine Learning algorithm	Data user	Find standardized datasets on soil organic carbon for Belgium neighbouring countries
CORDIS integration	Data user	Data on changes in boron content in the top layer of the soil in the southern part of Belgium in the 1980's assessed by European Research projects
HOLISOILS	Data user	Improve data accessibility and governance
Abandoned research project websites	Data & knowledge provider	Archive project websites Restore the website content from archive.org to EUSO/Cordis
INNOVAR	Data & knowledge provider	After project persistence of the resources created
ISLANDR	Data & knowledge provider	Guidance on how to archive data at project finalisation
Linkage between museum collection and knowledge sources	Knowledge user & provider	Enhance museum collections with links to further knowledge Better open and disseminate my resources to soil scientists globally
ORCaSa – Impact4Soil	Data & knowledge user & provider	Knowledge and data extraction from SoilWise Repository Display a subset of knowledge and data from Impact4Soil geographically focused on the EU.
Reproducible data flows	Knowledge user	Find data flows and methodology used to process similar farm data
Soilgrids	Data user & provider	Link between data used and relevant scientific papers Identify an optimal level of granularity of the Soilgrids product

Soil-O-Live	Data provider	SoilWise is explicitly mentioned in their agreement with EUSO on data sharing as facilitator of data archiving activities.
JRC – Soil researcher collecting and aggregating member state soil data	Data user	Access and combine datasets from EU member states To link to the data in a persistent way
BENCHMARKS	Data & knowledge provider	Optimal dissemination of the project results
JRC – Organizing Horizon Europe results		Access Horizon Europe results which are not available anymore learn from history to set up policy to prevent data and knowledge loss in future
JRC – Google is my favourite search engine	Data & knowledge user	A better search and find experience then Google
Prepsoil	Data & knowledge provider	Archive my project results in a way endorsed by REA/EUSO
JRC – Identify data gaps	Data user	Summarize the available data clustered by region, scale, time period, topic, at metadata level, as well as at data level

4.3.3 Use case 3: policy makers

SoilWise use case 3 focuses on facilitating policy makers in policy Making & Evaluation to safeguard soil led by Crea. Policy development should be based on accurate information. Governmental entities at the local, regional, and national levels are obligated to report various soil-related information to both the European Union and the global community. The role of SoilWise Repository in facilitating these obligated reporting processes will be cleared in the next iteration. This includes commitments under initiatives like LULUCF, CAP, LDN, and the upcoming EU Soil Health Law. Compliance with these obligations necessitates the availability of current and high-quality data, along with well-established workflows. Currently, there is a disparity in datasets, methods, and workflows across countries. The data's availability and level of detail may fall short of reporting requirements, and workflows often operate independently for different reporting obligations, leading to complications related to various policy domains or GDPR concerns. Additionally, there is room for improvement in enhancing the usefulness of inputs and results for other applications, such as national policy-making and evaluation. The current system is deemed inefficient, resulting in an underutilization of existing data, including those stored in data lakes. This inefficiency places additional burdens on authorities and overlooks opportunities to deliver higher-quality products and services.

Table 3 presents an overview of the current list of user story epics defined for this SoilWise use case. Note that in this working group also placeholder user story epics were established, that will be elaborated further in the next phase. These are marked with “TBA” description in the table 3.

Table 3 List of user story epics defined per UC3 Policy makers stakeholder group

User story epic title	User role	Key user needs
Common soil thesauri	Knowledge user	Describe my field observations and laboratory measurements using common code lists and thesauri for soil properties and procedures
SOC/Clay indicator	Data & knowledge user	Find the necessary data and information to be able to calculate the SOC/clay-indicator from the Soil Monitoring Law (SML) for my area of responsibility
Soil indicators general	Data & knowledge user	Access up to date soil monitoring data on my area of responsibility
Indicator Soc Clay (Policy advisor perspective	TBA	TBA
Human factor in soil salinity analyses and reporting in Italy	Data & knowledge user	Distinguish natural salinity, or salinity due to the sea level rise, from salinity due to anthropogenic use of soil, e.g. due to irrigation (from the data, knowledge and ontology perspective)
JRC – Analysing persistence of soil data in Europe	Data user	Information about accessibility, conformity and persistence of INSPIRE soil data in Europe in years 2024- 2030 Homogenous structure of output results
JRC – EU Soil Health Dashboard	Data user	Filter and download soil data from Horizon Europe Research projects SoilWise Repository should contribute to EUSO elements and improve the contents of the EU Soil Health Dashboard
JRC – EU Soil Health Dashboard gov	Data user	Filter and download authoritative national or sub-national (in case of federated MS) soil data
LULUCF reporting-flow	TBA	TBA
Cross-border erosion modelling for policy (INSPIRE data)	TBA	TBA
Bring together monitoring network data_LUCAS_NMS and provide info to harmonize them	TBA	TBA
Making IACS data available in SoilWise Repository	Knowledge user	Find which land management is applied in my country, up to the level of sustainable main soil management practices (eg tillage/no-tillage) Aggregate data on parcel / farm level
Pedotransfer function discovery and application	Knowledge user	Find applicable and validated pedotransfer functions for soil health indicators/properties to transform LUCAS and other available data analysed in different labs, with different methods to my national lab methods pedotransfer (ptf) function should be validated by an authoritative body or published in peer-reviewed literature
Facilitate INSPIRE reporting technical human barriers data model and data access exemptions	TBA	TBA
Peat-database map creation and continuation	TBA	TBA

Share mapping files of (meta)data and codelists	Knowledge provider	Capture and share mapping files of codelists for data provided by regional authorities generated as part of my harmonization efforts in a standardized way
Data access between government organisations technical + juridical	TBA	TBA
LULUCF action plan	TBA	TBA
JRC - Policy maker	Knowledge user	Needs to answer the following questions: • Where is the problem (this needs data)? • What can be done about it? (needs knowledge) • Is what we are doing making a difference? (needs monitoring and data) • Are things getting better? (needs monitoring) • What are the consequences of the (proposed or implemented) action, e.g., trade-offs and costs?
Catalogue with ESDAC, Cordis & Monitoring	Data user	Use a single search endpoint to search for data within ESDAC, Soil Mission results (Cordis) and Soil Monitoring projects (BonaRes)
Assign `high value` label to datasets		suggest/add a `high-value` label to datasets. This will rely on EUSO/ESDAC criteria, which are not identical to the HVD directive criteria

4.3.4 Use Case 4: Public Authorities and Living Lab actors

SoilWise use case 4 focuses on Enhanced capacities of Public Authorities and Living lab actors led by VL O. Adoption of FAIR principles enables public authorities to learn from colleagues on successful policy development. The FAIR principles play a crucial role in the dissemination of soil data by data providers across diverse stakeholder groups, facilitating effective re-use and knowledge generation, including for the SoilWise Repository. The contribution of SoilWise to FAIRification will be, therefore, investigated in this project. However, challenges hinder the widespread adoption of these principles, such as unfriendly tools, insufficient incentives, imbalanced costs and benefits for users and producers, and the need to navigate trade-offs between focusing on the quality or quantity of data and knowledge FAIRification.

Table 4 presents an overview of the current list of user story epics defined for this SoilWise use case. Note that in this working group also placeholder user story epics were established, that will be elaborated further in the next phase. These are marked with "TBA" description in the table 4.

Table 4 List of user story epics defined per UC4 Public authorities and Living Labs stakeholder group

User story epic title	User role	Key user needs
Finding Relevant Agricultural Long-Term Field Experiments Data (LTE) for MRVs	Data user	Easily locate and access Long-Term Field Experiments (LTE) data from soil-based data repositories Filter LTE data by crop type, growing season, and soil conditions Map-based search feature allowing researchers to pinpoint LTEs on a geographical map In-depth descriptions of LTEs through their metadata, including e.g., land use, soil types, farming techniques, and pest control strategies used in each study

		View metadata and summary information for each LTE dataset, including experimental setup, land use, and key findings, facilitating informed decisions on data selection Export the existing data into standard data formats (e.g., CSV, XLS) for seamless integration into modelling processes
A Long-Term Field Experiments (LTE) holder supplying metadata to facilitate networking	Data provider	Share my experiment metadata and data with the SoilWise Repository User-friendly registration process, allowing me to create an account and manage my profile Practical upload of experiment metadata, including details such as experiment name, location, duration, key variables, research objectives, and any other relevant information Attach files (e.g., documents, images, datasets) related to my experiments Set privacy preferences for my data, including options for making metadata and attachments publicly accessible or restricted to specific users or groups Search for experiments based on different criteria (e.g., location, keywords, experiment type), and my uploaded metadata should be discoverable by other researchers
An Agricultural Long-Term Field Experiments (LTE) holder permanently showcasing LTE metadata in a research paper	Knowledge user	Cite the metadata of our LTE located on the LTE overview platform in my research paper to permanently showcase our running LTE to the community
Where are living labs?	Knowledge user	Find living labs, I could participate in Filter search result on topic, location, size,... English translation of the main metadata elements
ENVISION – data for Machine Learning algorithm	Data & knowledge user	Explore details about soil-related living labs (Soil Mission), LL actors, ongoing and ended projects, including access to resulting data, information and/or products, via an interactive map, selection filter or general search function Access to soil condition monitoring data products/map, resulting from recent R&I projects Access recommended information on agricultural practices that can be applied to improve soil health (e.g., organic carbon), for a given site
Cmon	Knowledge user	Get an overview of projects and products that are enabled by the data and information produced by my monitoring network Easily connect from the main entry on my monitoring network to the entries that rely on data and results from my monitoring network Determine some statistics form the connections that can be made
Seamless integration of interaction with other platforms	TBA	TBA
Easy metadata for LTE, LL en Monitoring network actors	TBA	TBA
Feedback mechanism on quality	Data user	An option to leave feedback to the data holder

4.3.5 Use Case 5: business actors and governance models

SoilWise use case 5 focuses on business actors and governance models by investigating under which conditions farmers, land owners and technology providers on soil-related solutions and smart farming services can benefit from providing data to SoilWise or consuming services provided by SoilWise Repository. This use case is led by Gaia. It is important to identify new business opportunities around the SoilWise Repository to ensure the project sustainability. Table 5 presents an overview of the current list of user story epics defined for this SoilWise Use case.

Table 5 List of user story epics defined per UC5 Business stakeholder group

User story epic title	User role	Key user needs
Data Driven Ranking of Alternative Forest Transformation Scenarios	Data user	Get a list of forest transformation scenarios for my Stand through a DSS (Decision Support System) Stand data (geometry, tree species, tree age classes, tree count, tree height, timber volume) transmitted by DSS to be recorded at SoilWise SoilWise to return values for requested parameters (soil type (texture), soil thickness (excl. coarse skeleton), indicator of nutrient availability, plant-available nitrogen in kg/ha*yr)) to the DSS in a compatible data format along with a timestamp
Smart-farming data-driven advisory	Data user	Offer fertilization advice without unnecessary soil analysis as well as to be able to recommend crops to producers according to the quality and type of soil in the area
Access soil data	Data user	Identify per region or per microclimatic zone, the soil's composition data (texture, nutrients), high risk areas (for example for erosion, high nitrogen content, etc.) Access (raw and processed) data on soil composition per region (historical and current) Compare/evaluate similar data from different sources
Business User (Agro-supplier, trader, retailer)	Data user	Access to a wider database of data on soil information, obviously respecting ownership, and privacy Retrieve soil data quickly and user-friendly Benchmark individual results
Data2Knowledge Market Research	Data user	Identify data sources matching client's needs Contact data provider(s) and place business contracts Access/fetch and harmonize source data SoilWise Repository should reduce the amount of work and therefore time spent identifying data providers that are up to date and actionable, as well as compliant to policies and procedures

4.4 Generalised usage scenarios

Generalised usage scenarios are created from the user story epics and use cases to steer the development in the first iteration cycle. Usage scenarios summarize the main functionalities that are desired. The generalised usage scenarios form the base for further development and functionalities of the SoilWise Repository. A first effort was made in defining the generalised usage scenarios which will be further updated with input from the development team during this and the next iteration cycle. The first version of the generalised usage scenarios are:

- a user searches for data & knowledge in the SoilWise Repository to evaluate their fitness for a given purpose and downloads or views the data & knowledge;
- a user desires to upload some data at the SoilWise Repository to be processed within/beyond the SoilWise Repository;
- a third-party system will be connected to the SoilWise Repository to reuse data flowing through the SoilWise Repository (or stored at the SoilWise Repository);
- a user downloads or displays soil data upon her/his request in an interoperable form.

5 User stories / Requirements

5.1 Introduction

Requirements are the capabilities of an envisioned component which are classified as 'must have', or 'nice to have'. The selection of a component is guided by the 'must have' features first, and then the 'nice to have' features. Setting the priority is a process at the start of every iteration in cooperation with the stakeholders.

Required and optional requirements correspond to the user stories and will be derived from user story epics. They will be collected, prioritised, processed and validated as issues in the product backlog.

The collection and analysis of requirements was and will be carried out from the following three sources: (1) project Grant Agreement, (2) liaising with JRC (chapter 6), (three) user story epics (chapter 4) aggregated by SoilWise use Cases.

5.2 Requirements extracted from the Grant Agreement or JRC

An initial inventory of the SoilWise Repository requirements has been collected in a Catalogue of Requirements (not presented here). These requirements were described in the Grant Agreement and retrieved from initial communication with JRC. This catalogue was used during the Kick off Meeting in Brussels to provide the project overview and facilitate discussions shown in annex II. In the next iteration, the list of requirements will be complemented by requirements collected from user story epics and will serve as initial population of the product backlog used for SoilWise Repository development.

The catalogue serves as a repository for documenting the initial inventory of SoilWise Repository features. This includes features described in the Grant Agreement and features identified through initial communication with stakeholders (JRC).

The catalogue of requirements has the following structure:

1. **Requirement identification**
   - **Number:** Assigns a unique identifier to each requirement. This could follow a structured format like GAx.xx or JRCx.xx, where "x.xx" or "x.xx" represents a specific numbering scheme for each requirement.
   - **Description:** Extracts the exact wording of the requirement directly from the Grant Agreement or JRC document. This ensures that the original intent and context are preserved.
   - **Title:** Provides a concise and clear title or summary for each requirement. This title should capture the essence of the requirement without being overly detailed.
   - **Source:** Indicates whether the requirement comes from the Grant Agreement (GA) or the Joint Research Centre (JRC). This helps in maintaining traceability.

2. **Source Specific Information**
   - **GA Page:** Notes the page number in the Grant Agreement where the requirement is found. This information aids in quickly locating the source of the requirement.
   - **Chapter:** Specifies the section, chapter, or heading in the JRC document where the requirement is located. This provides additional context within the larger document.

3. **Project Specific Information – used in prioritization and development.**
   - **Deliverable:** Identifies which deliverable(s) the requirement fits to. This links the requirement to specific project outputs or milestones. This traceability helps in understanding the impact of requirements on project outcomes.
   - **Component:** Categorizes the requirement under relevant project components such as Data Management, Knowledge Management, Architecture, Use cases, Validation, Requirement, Project Management, Dissemination, and Communication. This categorization helps in organizing and prioritizing requirements based on project aspects and it is used in the product backlog prioritization.

Catalogue of Requirements serves as a central document for capturing, organizing, and communicating project requirements during the initial phases of the SoilWise project. It helps in cross-referencing use case requirements with the ones agreed in the grant agreement and the discussions with JRC. As the communication with REA and JRC is a continuous process, this document will have subsequent version of which requirements will be used in the Rolling plan. The document plays a pivotal role in facilitating discussions, creating a baseline for planning, and supporting iterative development based on evolving project needs.

5.3 SoilWise use cases requirements

The breaking down, classification, and prioritization of user stories from user story epics of the SoilWise use cases will go through an evolving process which will be further described in the follow-up deliverable. These activities occur prior to each development iteration.

- user story epics are typically broken down into user stories or requirements which can be picked up by a development team in a single iteration;
- the process of classification involves the identification of story readiness, expected effort to the development teams and expected value to end users to prepare for the prioritisation;
- prioritisation involves moving user stories from the back log to the sprint log in a specific order.

The initial activities on breaking down and classification started on 19 January 2024 at the WP1 Use cases and Requirements meeting in Heerlen, The Netherlands. As part of the preparations for these activities and keeping the project efforts in line with the technical team, an initial business analysis of defined user story epics was carried out. The first step of this analysis was to evaluate the degree of detail of user story epics and then proceeded to the indication of technical components.

5.3.1 Technical components

To be able to extract the user stories/requirements arising from the individual user story epics in a structured way, the first step was to extract the technical components. The requirements will be extracted directly in connection with the given technical component in the following phase. Note that this process will be repeated two more times in the following iterations. The well-developed user story epics were ranked by the technical team as well as by the use case leaders and assessed against the JRC requirements and grant agreement. In a first step, the technical components for 34 of the shortlisted user story epics with a sufficient level of detail were extracted. The extracted technical components are listed in the Table 6, along with several user story epics, who

mention it. The frequency of certain components in the user story epics does not have to correlated with the importance of that component for the use cases. This is a first indication of relevance and will be validated and verified with the use case leads during the co-designing meetings starting at the end of February. Technical components will be further assessed in D1.3 [M8] and detailed regarding their functionality.

Table 6 Overview of technical components and their functionalities extracted from user story epics

Technical component	List of functionalities	No of user story epics with occurrence
User management component	Sign-up Authentication Authorisation	33
User Interface: Dashboard	Configurable UI/UX Metadata & data search Advanced filtering Data download Data export Export to print Display of benchmark indicators Chatbot Knowledge output Past, future visualization Real-time visualization Display citations, references	24
Data2Knowledge component	Extraction of KPIs from data Generating soil health maps Extended metadata items (publications, products, usage) Alignment with existing data “High-value knowledge” identification	18
Certification & governance management component		14
Data standardization	Standardization, Conventions Codelists	12
Cloud storage component	Store and retrieve data, information, KPIs	8
Data processing component	Data interoperability Transfer functions Extrapolations correlations	9
Data quality assurance	Completeness of metadata	9
Data provision component (API)	Automated data provision to third parties	7
Collaboration & Networking component		7
Manual data upload component		6
Localisation	User interface in multiple languages	3
Map viewer component		3
Data upload API		2

Sophisticated LLM		1
API Data & Knowledge extraction		1
Machine Learning component	Labelling scientific data	1
Integrations	*Portals:* CORDIS, INSPIRE, LUCAS, Geopunt, DOV, metadata Flanders, Italian national *Repositories:* Zenodo, ESDAC, BonaRes, EUSO, Dataverse *Projects:* SoilHealth Toolkit (BENCHMARKS), INNOVAR, ORCaSa EUSO Soil Health Dashboard CRM systems	33

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6 User groups JRC, ESDAC and EUSO

6.1 Introduction

The SoilWise Repository will be part of European Union Soil Observatory (EUSO) and therefore coordination activities are needed to support the cooperation with ESDAC and EUSO. This includes co-defining the cooperation governance and scheduling. The scope of the meetings refer to defining the roles, responsibilities, communication means, the frequency of the regular meetings or the needed workshops throughout the project, etc. Cooperative activities will focus on:

i) the refinement or definition of the SoilWise Repository requirements (functional and non-functional, transition and stakeholder requirements) considering the technical capacity of EUSO and ESDAC and the evolving requirements of EUSO;
ii) the architecture and governance of the repository but also issues related to the IPR management;
iii) interaction with Mission Soil research projects.

This chapter describes the cooperation with ESDAC, EUSO and the Soil Mission Cluster, and the next steps in the project.

6.2 JRC, ESDAC and EUSO and project requirements

The Joint Research Centre (JRC) is a vital component of the European Commission, providing independent, evidence-based knowledge and scientific expertise to support EU policies aimed at positively impacting society. Since the SoilWise Repository should become part of EUSO, the JRC requirements to the repository are essential to the project. To understand the JRC requirements well from the very beginning of the project, a meeting took place before the kick-off of the SoilWise project, in ISPRA (February 2023) between JRC and WP leads of the SoilWise project. This resulted in documented requirements from JRC for the repository. These requirements cover topics such as the expected source data and knowledge, expected results of the Mission Soil projects, data and metadata, knowledge, storage, discovery and publishing services, AI, and ML services and overall ESDAC, EUSO, SoilWise cooperation. Discussing the JRC requirements early on allowed them to be used well in the preparation and implementation of the co-design process. For example, the JRC and the grant agreement requirements were used for writing specific user story epics and for prioritization.

Since that moment, several meetings between JRC and SoilWise took place, such as The EUSO Working Group on Data and Integration (November 2023), EU Soil Mission Week (Madrid, November 2023), Mission Soil Platform – Data and Knowledge Cluster (February 2024) and several others. The mutual need for regular exchange was recognised, both based on the needs of the project and on evolving requirements from the JRC. SoilWise and JRC have agreed to monthly meetings with a running agenda. JRC and SoilWise will also co-lead the Data and Knowledge Management Cluster from the Mission Soil Platform where exchange and interaction with the Mission Soil Projects will be facilitated.

As JRC /EUSO will integrate the SoilWise Repository and maintain it after the end of the project cycle, they represent a vital actor in the development of the platform and the success of the SoilWise project is linked with a continuous cooperation between the project and JRC.

6.2.1 ESDAC

The European Soil Data Centre (ESDAC) is an organisational unit within the Joint Research Centre (JRC) tasked to facilitate Soil Science in the EU. ESDAC operates a technical infrastructure to facilitate their activities. ESDAC is one of the most visited JRC websites, with over fifty thousand downloads since the start and having around one hundred blocks of data. ESDAC has a rich history in facilitating Soil Science within the EU. Situated at JRC, ESDAC homes valuable resources such as LUCAS-based maps (Tóth, et al 2013) and results from EU projects. However, it has faced challenges in integrating project results due to licensing issues and other complexities. SoilWise aims to enhance ESDAC's technical infrastructure and foster regular interaction between the SoilWise and ESDAC teams, facilitated by JRC, to ensure alignment of needs and expectations.

6.2.2 EUSO

The European Union Soil Observatory (EUSO) is a community of European Soil Scientists facilitated by ESDAC/JRC. Launched in 2020, EUSO has been established to satisfy the cross sectorial knowledge needs of policy DGs where soil information is highly pertinent. It hosts initiatives like the Soil Health Dashboard and Soil Policy Dashboard, with the intention to absorb ESDAC's functions eventually. While benefiting from the outcomes of the Mission 'A Soil Deal for Europe', EUSO will ensure the legacy of knowledge and data produced by the Mission. In this context, SoilWise primarily focuses on enhancing the technical infrastructure supporting EUSO's activities, and will develop and test a prototype for an open access, user friendly long term knowledge and data repository, taking due account of the requirements emerging from the evolvement of the EUSO. After the project lifecycle, SoilWise Repository will be integrated and further developed and maintained by EUSO. EUSO's mission is to:

- further foster networking, cooperation and partnerships among users of soil data and information, use the outcomes of targeted research to underpinning policy cycle through meaningful indicators and assessments;
- collect high resolution, harmonised and quality assured soil information (showing status and trends) to track and assess progress by the EU and beyond in the sustainable management of soils and restoration of degraded soils;
- use the outcomes of targeted research to underpinning policy cycle through meaningful indicators and assessments.

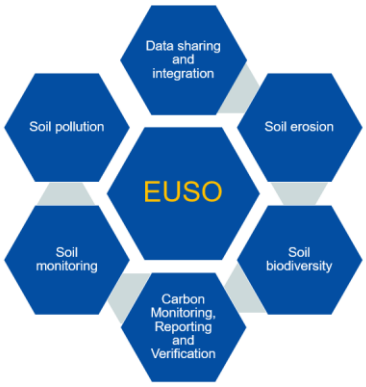

Figure 8 EUSO Working Groups

6.3 Mission Soil Platform

The Mission Soil Platform functions as a centralized hub for understanding the Mission Soil and for participating in its initiatives to support the roll-out of the Mission and related R&I activities, facilitate collaboration among the Mission Soil-funded projects, and increase awareness about the importance of soil, the challenges it faces, and the solutions that exist thanks to the latest research results. One of the frameworks for these objectives is the Mission Soil Clusters. At present three clusters are identified, on Data and Knowledge Management, on Indicators and on Stakeholder Communication.

The Mission Soil Cluster on Data and Knowledge Management serves as a means of communication for projects under the EU Mission: A Soil deal for Europe within Horizon Europe. It aims to foster a community dedicated to improving data and knowledge sharing practices and facilitating exchange on these topics. SoilWise, a Mission Soil project, as well, has an explicit goal to facilitate the Mission Soil projects in advancing the persistence of their project results, as well as provide mechanisms to discover them. JRC and SoilWise will co-lead the Data and Knowledge Management Cluster, facilitated by the Mission Soil Platform. The Cluster will be the main channel for communication between SoilWise and the Mission Soil and other interested projects. At the time of writing this deliverable, the first kick-off meeting of the Cluster is scheduled and the operation of the Cluster is still being designed. Formal communication with the Mission Soil Projects is managed by JRC. The collaborative Mission Soil projects are automatically considered members of the EUSO WG on Data integration.

6.3.1 Mission Soil Key objectives

Collaboration with user actors such as JRC, EUSO, and the Mission Soil Platform and the Mission Soil Projects is essential for the success of SoilWise. By aligning with their requirements, fostering continuous communication, and actively participating in collaborative initiatives, SoilWise aims to ensure the seamless integration, adoption, and long-term sustainability of its repository and serve the target groups identified in the project. These user actors are essential in enhancing the Mission Soil key objectives:

- reduce desertification;
- conserve soil organic carbon stocks;
- stop soil sealing and increase re-use of urban soils;
- reduce soil pollution and enhance restoration;
- prevent erosion;
- improve soil structure to enhance soil biodiversity;
- reduce the EU global footprint on soils;
- improve soil literacy in society.

7 Validation framework

7.1 Introduction

The development of the SoilWise Repository will use Agile methodology, that means an iterative approach driven by user needs. This enables us to develop a product as close as possible to user needs and to consider possible changes in user needs during the development stage. Thus, it is necessary to rely on a framework allowing effective communication between users and developers, validation of developed products by users, and flexibility on the developer's side to take change requests into account as soon as possible. Such a strategy is called a validation framework.

7.1.1 Goals

The objectives of the validation framework are:

- to list the functionalities that the SoilWise Repository must have in a way that enables a good understanding by users and developers,
- to determine the criteria for controlling the conformity of the developed components to the user needs,
- to organize the development stage guaranteeing flexibility, communication, and product conformity,
- to organize the test stage for conformity control.

The validation framework corresponds to a list of features that organize the workflow of information and actions but also to an organizational scheme. It needs a description of the functionalities to be developed (user stories/requirements), the criteria that enable to verify that the developed component corresponds to the user needs (acceptance criteria), the definition of tasks for the developers (backlog) and the workflow.

The user stories/requirements will guide the development of the SoilWise Repository aiming at defining tasks for the developers. But, after the development is done, it is necessary to verify that the developed component fulfils the requirements.

One of the goals of the validation framework is to use acceptance criteria determined for each user story/requirement coming from the user story epics and established during the co-design process. An acceptance criterion is specific to a user story and must possess the following qualities: clarity, conciseness, testability and be result-oriented. In addition to acceptance criteria, other criteria must also be met for the Definition of Done (DoD), like all unit tests passed, available complete documentation, etc. The DoD criteria apply to all user stories/requirements, while acceptance criteria are specific to a user story/requirement.

7.1.2 Features/Components

The main components of the validation framework are:

- **user story/requirement:** it corresponds to a description of a functionality from the user point of view.
- **acceptance criteria:** it enables to confirm that the technical component developed for a user story epic or user story/requirement gives the expected result for the user.

- **product backlog:** it is an ordered list of all functionalities, reported bugs or technical tasks relevant for the end product. The list is ordered by priority.
- **sprint:** it is a small timeframe during which unit tasks have been defined.
- **Sprint backlog:** is composed of the set of product backlog elements chosen for the sprint, and an action plan for achieving it.
- **Task:** it is the smallest segment of work that must be done to complete a user story/requirement.

User stories/requirements are derived from the user story epics and user personas determined in task 1.1. They document stakeholder requirements from the users' perspective, emphasizing value or gain. They serve as a bridge between business and solution requirements and may include multiple requirements. The INVEST (Wake, 2003) criteria could be used to check if the user stories/requirements are well written and are widely used by the IT community:

- Independent: user stories/requirements must be independent so that they can be done in any order
- Negotiable: they are a way of discussion between users and developers
- Valuable: they must bring a value to the user
- Estimable: an estimation of the effort to realize it must be possible
- Small: must be realized during one sprint
- Testable: at least one acceptance criterion can be defined to confirm its completion.

User stories/requirements must be written with the users and are part of a continuous process as user needs evolve in time. At the first stage, they can be too big and thus will need to be broken into smaller ones, as is the case in the first iteration of the user needs elicitation process of this project as described in chapter 3.2. It is important to note that it is collaborative work.

Acceptance criteria form the basis of the acceptance testing of the user stories/requirements. Their main purpose is to give a clear and precise description of the functionality to develop. They are based on the user interaction with the repository as described in the user story/requirement and describe how the repository must react to this interaction. Negative interactions (for example, what is expected when an incorrect password is given) must also be defined. If the user story/requirement explains what the user expects from the functionality, the acceptance criteria describe the minimum conditions to satisfy. For example, a user story/requirement could be to have a fast download. But what is a fast download? The acceptance criterion defines it considering, for example, that it must take no more than 3 seconds to download a file of a certain size.

Each acceptance criterion must be testable independently and have scenarios for acceptance and failure. It must be understandable and testable. Several methodologies for writing acceptance criteria could be used (scenario-oriented, rule-oriented, etc.) depending on the type of criteria to apply. Some criteria could be performance indicators, depending on the user story/requirement.

In addition to the acceptance criteria, **Definition of Done** (DoD) **criteria** should be defined. These criteria apply to all user stories/requirements and are generally driven by the good practices of development. For example, part of these criteria are unit tests, integration tests, availability of documentation, etc. They are performed by the developer at each step of development.

The product backlog is the practical document or tool where user stories/requirements and functionalities to be delivered for a solution are listed and prioritized, along with acceptance criteria. The backlog is scalable and refined

regularly in a continuous process. A crucial step is the prioritization of the user stories/requirements as the priority stories are those used to define the tasks to be realized in a sprint.

A **sprint** is the process in which functionality or increment is developed. A sprint typically has a duration of one to several weeks. The end product to be developed needs several sprints. This iterative approach needs frequent communication and feedback and enables to adapt the development to changes in user needs. At the beginning, a sprint planning is organized to determine the sprint backlog which corresponds to the tasks to be realized during the sprint. A task is linked to a user story/requirement, but a user story/requirement can be developed using several sequential tasks during one or more sprints. When a task is achieved by the developer, (s)he first checks the compliance of the task to DoD, but this can be also done on a continuous process during the development phase. When the developer considers the task achieved, the acceptance criteria of the user story/requirement that apply to the task are used to validate if the task is considered conform to what was expected or not. This is done during the sprint review. If the task is compliant to the acceptance criteria and the DoD, then it can be considered complete, if not, corrective actions will be defined and added as a task in the next sprint. The sprint retrospective enables to improve the development practices.

7.1.3 Workflow and implementation

The workflow is the following as shown in figure 9:

1. Insertion in the product backlog of user stories/requirements, acceptance criteria, and functionalities;
2. Product backlog review where user stories/requirements are prioritized;
3. Sprint planning and definition of the sprint backlog;
4. Development;
5. Verification of the acceptance criteria and DoD criteria during the sprint review;
6. Discussion about practices improvement during the sprint retrospective;
7. Go to the step 2 for the next sprint.

The product backlog can be augmented with new user stories/requirements and their acceptance criteria during the sprints as it is a continuous process, but the new additions will not modify the backlog sprint and are considered for incorporation only for the next sprint.

At mid-term of a cycle and at the end of a cycle, during the product backlog review, the rolling plan is consulted to know if major changes must be considered.

Concerning the tool for sprints, as it is for used by developers, a Devops tool such as GitHub can be used. The choice will depend on the habits of different developers coming from different partners. This decision will be taken between February and May 2024, the development phase of the first iteration cycle.

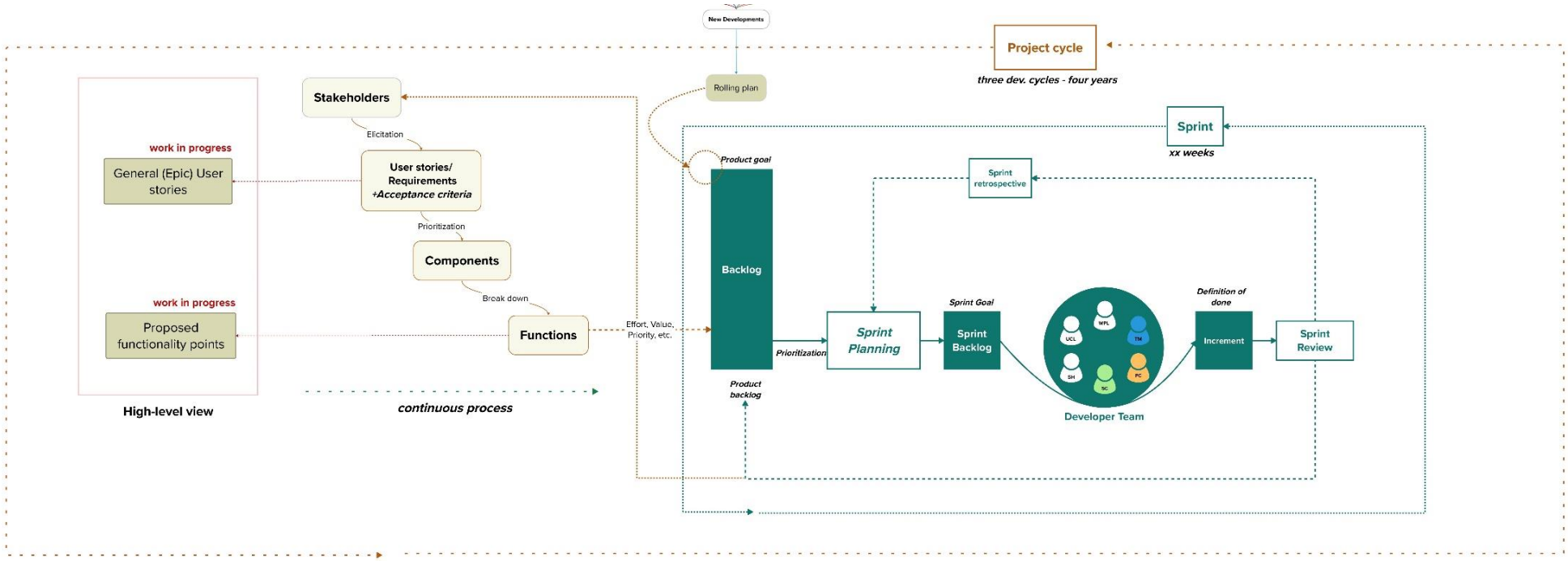

Figure 9 The Agile process flow of the validation and verification framework

7.2 Responsibilities

Task 1.3 leader (INRAE) is responsible for the implementation and management of the validation framework, for coordinating the supply of the product backlog by user stories/requirements and acceptance criteria, for curating the product backlog after acceptance of user stories, for organizing the product backlog reviews, the sprint backlog reviews and the sprint retrospective with the Technical Manager. The Task 1.3 leader has the role of coordination and communication with the SoilWise partners, on the validation framework, supported by the project coordinator and the WP6 leader.

The Technical manager is responsible for the sprint planning, sprint backlogs and development phase. It ensures that the technical aspects of the project align with the sprint backlog and involves the developing team in the product backlog reviews, sprint reviews and sprint retrospective.

WP leaders and SoilWise Use Case Leaders have the role to engage their active partners to supply the validation framework with new user stories/requirements and acceptance criteria, to participate to the product backlog reviews, the sprint backlog reviews and the sprint retrospective, including test of the developed technical components using acceptance criteria.

The project coordinator (PC) has an overall oversight of the project and its objective and has the role to ensure alignment of the validation framework with the project's strategic goals.

The Scientific coordinator (SC) ensures that the validation framework aligns with the scientific objectives and goals of the project.

8 Rolling plan

8.1 Introduction

The project will have three iterations. The prioritization of user stories/requirements in each iteration will lead to making choices about functionalities to be developed, technologies to be used, contexts on which to rely. But during the duration of the project, many changes in technology and context can occur. The legislation is always changing. For example, the Data Act is not yet promulgated but will come into force in 2024. What changes will this have on our technical choices? In software development, technologies evolve very quickly, and a new technology can be rapidly adopted by developers making perhaps our choices obsolete. New infrastructures may also appear and become unavoidable. Other sources of changes will be from JRC and REA's evolving user stories/requirements relating to the Soil Mission Projects and the dynamic policy landscape at the European Commission level. Thus, it is necessary to develop a methodology to take all these changes into account.

8.1.1 Goals/objectives

The objective of the rolling plan is to develop a methodology for considering the internal and external developments that may generate changes to the SoilWise Repository design and development. One of the main requirements of the SoilWise project is to stay in line with the most recent developments and innovations in the field of soil knowledge and data management, to make sure the repository remains, relevant, functional, and attractive for stakeholders to use. The methodology of the rolling plan will be based on a tool that enables the partners to gather in one place a description of changes that could have an impact on the choices to be made for the development of the SoilWise Repository. Every change in the legislative field, soil knowledge, data management, development technologies, etc. will be listed in this dedicated document or tool. A list of categories for classifying the changes could be proposed to facilitate its use. This document could be an excel sheet or a text file accessible to each collaborator of the project.

Regularly (minimum one time per iteration cycle), a review of the changes listed in the document will be done to determine the impact each internal or external development listed in the rolling plan could or could not have on the choices made for the design and development of the SoilWise Repository. In case of a possible impact, a discussion will be held to determine if corrective action should and can be made during the current iteration or the next one.

8.2 Responsibilities

The management and implementation of the rolling plan is a collaborative work between SoilWise partners. Task 1.3 leader (INRAE) is responsible for the definition of the rolling plan, setting up the tool for (shared living document) and has the role of curating the new development items that are collected. The Task 1.3 leader is also the rolling plan owner and has the role of coordination and communication with the rest of the partners, on the rolling plan, supported by the project coordinator and the WP6 lead.

The project coordinator (PC) has an overall oversight of the project and its objective and has the role to ensure alignment of the rolling plan with the project's strategic goals. The T1.3 Lead will keep the partners updated to the rolling plan and will harmonize with the PC who is responsible for the communication with the Project Office.

The Scientific coordinator (SC) ensures that the rolling plan aligns with the scientific objectives and goals of the project and participates to the review of the rolling plan. The Technical manager (TM) ensures that the technical aspects of the project align with the rolling plan and continuously involves the developing team in validation of the new items from the plan.

All work package leaders, with their specific expertise and focus (data handling, knowledge processes, technical components, use cases etc.) have the role to contribute to the rolling plan by updating the current state of that specific matter and to engage the active partners and task leaders of their specific WPs to this activity.

The SoilWise use case leaders will also contribute to the rolling plan supported by the Task 6.2 leader, through the engagement plan with the stakeholders by supporting the elicitation and validation of changes in user needs related to their use case. These activities will happen during the first phase (co-design) and the final phase (demonstration) of each development cycle. T6.2 will facilitate the stakeholder engagement together with WP1 and WP5 leaders respectively. The developments of the Soil Mission projects will be closely followed by the T6.2, and T1.2 leaders, together with the PC and the SC which will result in items that are collected in the rolling plan.

The task 1.2 activities will generate input in the rolling plan coming from JRC and EUSO which can have a higher priority for the decision making in the follow-up iterations, based on the discussion and priorities of the EC (European Commission) governing bodies at that specific point. The T1.2 leader is responsible of incorporating any changes related to user stories/requirements, technical developments, or context of JRC/EUSO to the rolling plan.

T1.3 leader will organize the rolling plan items so that they can be evaluated and prioritized by the Scientific Coordinator, the Technical Manager, and the Project coordinator (with input from WP leaders, UC leaders, JRC, REA etc.) and included in the following iterations. T1.3 leader will develop a risk management for the rolling plan, propose risk mitigation strategies and adjustments to the plan accordingly.

8.2.1 Coordination with other Work Packages

The rolling plan activities within Task 1.3 should be coordinated with the activities and advancements in other Work Packages (WP2-5) to ensure alignment and integration across the project.

The process of rolling plan involves key aspects, such as:

Creation of Tool (T 1.3): Develop a dynamic tool for the rolling plan (T 1.3), serving as a living document that visualizes and reports the latest developments and innovations. The items included in the rolling plan will be also gathered from the elicitation workshops, stakeholder engagement events (T6.2) and JRC and REA regular meetings.

Follow-up and Listing (all WPs, Use Cases): Track and list new developments and technologies that may impact user needs, establishing a repository with contributions from all WPs and use cases.

Review and Assessment: Regularly review and assess the listed developments and changes in organized meetings involving all WP and SoilWise use case leaders, and chaired by T1.3, PC and TM. The aim is to understand the value and impact of these changes and support the decision on whether to incorporate them into the project.

Approval and Update (T1.1, T1.3, T1.4, T 1.5,): Once changes are approved by the Scientific Coordinator, the Technical Manager and the Project coordinator, update relevant information (user stories/requirements, technical components or functionalities) as needed to aid in prioritization and product development and place the updated items in the product backlog (T1.3) for tracking in the validation process (T1.4). As new backlog items emerge, refine the product backlog accordingly.

Implementation of Changes (T1.4, T5.2): The enhanced backlog, with updated items, will play a crucial role in the validation process and contribute to the refinement and technical validation of existing solutions and support the population of the repository (T4.3). This crucial process ensures that during T5.2, the use cases can seamlessly implement, apply, and demonstrate the validated and improved solutions.

This process offers numerous benefits, including adapting to evolving user needs, seamlessly integrating significant solution changes, preventing unnecessary modifications, and providing insight into how changes will impact the final product.

8.3 Documentation and reporting/output

Documentation and reporting are critical aspects of monitoring and implementing a rolling plan. The documents and tools used for this purpose are providing transparency, accountability, and a means to communicate progress, challenges, and adjustments within the SoilWise consortium and with the stakeholders.

8.3.1 The rolling plan document

The rolling plan document is the central tool for collecting, verifying, and implementing new developments throughout the project's lifecycle. An excel work sheet will be used to organize the information. The table header will contain the following titles (Annex III):

1. **Item ID number** – a unique identifier for each development or initiative
2. **Insertion date** – the date when the item was added to the rolling plan
3. **Item description** – a detailed description of the new development or initiative
4. **Item author** – identification of partner organization that included the new development or initiative
5. **Category** – categorization of the item by source (e.g. Policy, technology, Regulatory, JRC, REA, etc.)
6. **Impact on the SoilWise Repository** – Score 1-5, where 1 is little to no impact and 5 is significant impact in the development and scope of the SoilWise Repository
7. **Priority** – Score 1-5, where 1 is low priority and 5 is high priority; to be defined by PC, SC, and TM in consultation with the development team and WP Leads
8. **Risk –** Score 1-5 where 1 is low risk and 5 is high risk
9. **Risk Mitigation –** Mitigation plan for the identified risk
10. **Date** – start and/or end date – commencement or announcement
11. **Responsibility** – the partner responsible for monitoring and responding to the development
12. **Notes/Comments** – additional information, context, comments relevant to the item entry
13. **Revision/ Change** – a log of revisions or changes of the development, with dates and reason
14. **Proposed implementation** –implementation strategy to be filled by the Product Owner (multiple persons)
15. **Date of proposed implementation** – date with respect to iteration / sprint planning

8.3.2 Communication and reporting

Every few sprint reviews (depending on need and stage of the development) there will be progress meetings chaired by the T1.3 leader including the stakeholders relevant for the rolling plan implementation. The new developments will be presented, together with the description referring to impact to SoilWise Repository, priority and risk score that will inform the group's decisions for the plan of action in the following iterations. The minutes of the meetings will be circulated by the chair to the group and the external stakeholders. The new items will be included in the rolling plan. A log of changes and revisions of the rolling plan will be made together with justification of the decisions, KPIs used and validation from the development team. The minutes document together with the rolling plan change log and a risk management document, will be used to create a report that states the final decisions made by the PC, SC, TM, and WP leads.

The frequency of the rolling plan evaluation will be defined per development cycle, or sprint which will align with the project's needs and stakeholder expectations. Other unregular meetings can be organized if the rolling plan document has a significant input in a short time, or some items are considered of high priority and impact. The rolling plan will be available to all partners and REA/JRC as read-only, only the task 1.3 leader having the right of editing. In this way the task leader can curate and organize the information in a proper way, and the stakeholders can be kept updated with the newest developments.

The rolling plan will go through a series of regular documentation review and reporting processes to identify areas for improvement. The rolling plan owner will solicit feedback from the consortium partners to enhance effectiveness of communicating and reporting.

9 Challenges and mitigation plan

This deliverable is the first of two versions. At the start of each iteration of the development of the SoilWise Repository, the users will be consulted and at the start of the third cycle, the results will be used to update the requirements and description of user needs in D1.2 (M36).

This document describes the methodology used and the results achieved in generating requirements, validation framework and the rolling plan during the first iteration of the co-design process. Several challenges and risks have been identified prior and during the activities and are centralised in table 7 to serve as input in the updating of the methodology, create a mitigation strategy for the partners involved in the tasks and improve the predictability of the results.

Table 7 Challenges and mitigation

Risk or Challenge (short description)	Impact (cost, technical, schedule; or high-medium-low)	Likelihood of occurrence (high-medium-low)	Severity of occurrence (high-medium-low)	Precaution measure (short description)	Mitigation plan	Cost of mitigation (high-medium-low)
Differences in terminology and ways of working in user elicitation in the consortium	medium	high	low	Allocate more time for definition of common terminology in beginning of project	Repeated discussions with all partners, inclusion of definition chapter in D1.1	low
User stories / requirements						
Missing representative user groups identified through stakeholder mapping	medium	high	low	Have user cases populated by use case leaders and partners	Use fictive personas specified in detail (job description, education level, …)	low
Successful implementation of user	medium	high	low	Assess the availability of data and knowledge	Prioritize different user stories,	medium

story/requirement depends on access to data and knowledge that is not available				prior the prioritization	generalize acceptance criteria	
Users do not fully understand the scope of SoilWise Repository under development	low	high	high	Involve technical group members to provide more input about the vision of the SoilWise Repository	Perform stakeholder elicitation process iteratively, Follow AGILE approach, Present the concept and functionality of SoilWise Repository (in the next iteration cycle) prior to interviews	medium
Collected user requirements are relevant to systems benefiting from SoilWise, not valid for SoilWise directly	low	high	low	Present the concept and functionality of SoilWise Repository (in the next iteration cycle) prior to interviews	Perform critical business analysis of requirements in relation to SoilWise UC05	medium
Validation framework						
Terminology Usage scenarios, user stories, requirements etc.	high	high	medium	Define the groups of the items at kick-off; revise often	Large meetings to discuss and align on terminology and additional one to one meetings chaired by WP1 lead	high
Overlapping roles in the validation framework	Medium	low	Medium	Define the roles and interdependence in the deliverable	PC and WP1 lead can chair alignment meetings if the issue is happening	Low

				based on partner meetings		
Agile methodology cross-organizational	High	High	High	Create an open space for the backlog and clearly define the roles	Use sprint review for improving the processes and not disturb the development cycles	High
Rolling plan						
Partners including items regularly and pro-actively	Low	Low	Low	Create an easy tool (Excel) where the partners can add inputs and send regular reminders	Address the issue in ExBo meetings and engage partners with the help of WP6 lead	low
Some items require urgent attention	Medium	High	Medium	Define the implementation of the rolling plan clearly with respect to the sprint planning	Meetings with the development team discussion potentially shifting direction of ongoing development or waiting for a new sprint cycle by identifying cost and impact	High
JRC / EUSO input different than GA requirements	Medium	Low	High	Continuous communication with JRC and other stakeholders for keeping the project in the context of the GA	Discuss with REA amendments to GA	High
Differences in the partners' approach to the prioritization of items in the rolling plan	High	Medium	Medium	Define roles in the rolling plan clearly	PC will coordinate alignment meetings with the partners	High

9.1 User story epics challenges and risks

The SoilWise project is at the moment of writing in the initial phase. The process of defining user story epics does not include views of stakeholder groups yet, because the user groups have not been defined yet. Therefore, the user story epics in this iteration are mainly from a fictive persona perspective. To stay as close as possible to actual users, the persona is specified in detail (job description, education level, …). Fortunately, the SoilWise consortium comprises multiple experts, that have wide knowledge of the stakeholders and could sufficiently describe these fictive personas based on their previous experience. In the next iteration cycle, interviews and workshops will be performed with stakeholders to validate these personas. Any gaps in the initial user story epics and actual stakeholder needs, will be addressed by writing new set of user stories by involving he actors and thus completing the user groups.

There were also several challenges already identified during the process of defining user story epics. For instance, multiple user story epics require data, the provision of which in a wider geographical scope is not currently verified. The successful fulfilment of the needs of these user story epics is dependent on the willingness to share data and knowledge by the holders and cannot be directly influenced by the SoilWise project.

Initial business analysis of user story epics also revealed, that certain user requirements are not directly linked to the SoilWise Repository as currently perceived and described in the Grant Agreement, but are valid for systems which in the future could benefit from the data, knowledge and services that SoilWise will offer. In these cases, there will be a need to critically consider the impact on the required functionality resulting from SoilWise Use Case 05.

A general challenge that arose especially in the initial phase of defining user story epics is linked to the fact, that the SoilWise Repository development efforts are yet to start, which significantly increases the effort of users to understand the project output and develop expectations. For the next iteration of the stakeholder elicitation process, there will be a first prototype of SoilWise Repository available, which will help to make the discussions more tangible.

9.2 Validation framework and rolling plan challenges and risks

The Validation framework and the rolling plan are implemented starting Month 7, that coincides with the start of the development phase. Thus these frameworks are defined in this document as part of the task 1.3 work, but are going to be in effect after the submission of this deliverable. In this context, several risks can occur for which the validation framework and rolling plan chapters should take in account. Other issues that might appear and are not identified will be highlighted in the next version of the deliverable.

Since the kick-off of the project, there were challenges in aligning to the same terminology of the user story epics, user stories/requirements and the connecting terms. The technical group responsible for the development and the user group responsible for the requirements collection could have different definitions for the same items. Also, inside of each group there are nuances that needed clarifications. This issue delayed some activities and slowed down the process of gathering the needs from the users. The WP1 lead, together with the PC arranged several meetings to discuss in detail the issues referred to the terminology and proposed a diagram to align all the partners. This constant effort to clear up the terms require a lot of time, but it concluded in consolidated view and expectations from the partners. This will be a continuous process if more clarification is needed, and will be further be solved during in person meetings (Milestone 1 meeting, 27th of March).

The agile approach to software development has many advantages that made it favourable for many organizations. However, an international consortium with organizations spanning the EU and using different software and tools, makes the agile approach more difficult. The product backlog which is the centre of the validation framework needs to be designed and implemented on a platform that is accessible to all partners and works with the different approaches to software development. The PC, together with the TM and SC will set it up with feedback from the developers. In the same fashion, the cross-organizational work is streamlined by carefully tailoring and defining roles in the development and the validation framework. The process should be continuous and smooth and any issue regarding difference in opinions or priorities should refer to the methodology described in this document.

The rolling plan will allow new technological, user driven, policy or other developments to be taken in account in the development process and thus maintain a dynamic and agile approach. For the success of this feature, all partners are required to populated the rolling plan with relevant information, providing the required characteristics for each entry (see table 9 in annex III). The new items relevant to the development can only be taken in account if they are passed through the rolling plan, where the task 1.3 lead will organize them and prepare for prioritization. In this process, different partners or stakeholders can have different views in the importance of certain items that should be included in the following steps. This issue can be solved by having clear roles defined and having additional alignment meeting where the PC, TM and SC should nurture a productive discussion on the reasons and metrics used in prioritization. Other actors with higher stakes in the outcome of the project, such as JRC could exercise some urgency matters to be taken in account. The PC will liaise with them together with the T1.2 lead and the rest of the partners. The prioritization will be made in the context of the GA and if needed, discussion of potential amendments to the GA to incorporate newly and crucial developments will take place.

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Annex I: User Story template

Use Case: UC-xx

User Story: US-xx

Author:

Organisation:

Date:

Version: vX.X [Draft / Final]

A **User story** is a statement written from the point of view of the user, and describes the functionality needed in a solution, to provide the user with some value. User Stories are used by the development team to prioritize the activities and build the solution. A User story is neutral on how a solution is implemented and when the activity will be scheduled.

Short user story description:

As an <actor>,
I want to have/be able to <function>,
So that I <business reason>.

The **actor aspect** preferably is an actual potential user we can interact with, else a fictional persona. Be specific on the persona, what role does (s)he have on an organization, daily activities, education level, age, etc.

The **functionality** should be a concrete activity: 'Sort dataset registrations alphabetically', 'Locate data on nitrogen deposits in West Flanders in the 90's', 'Share my farm data with a research institute for 2 months, make sure only they can access', 'Combine data on distribution of soil physical parameters from France and Spain in a small area in the Pyrenees', ‘Assess existing data sources and procedures to identify risk areas for desertification in the Mediterranean countries’

The **business reason aspect** (or benefit) should be as SMART (Specific, Measurable, Achievable, Relevant, and Time-Bound) as possible in hours saved, euro's, percentage of increased efficiency/yield/soil health etc.

Extended user story description:

I am <actor>, who works at <organisation>, which focuses on <field of expertise/applications> in <country>, in the role of <job title>, my educational level is <high school/professional training/higher education>. My main target group are <land managers/researchers/small and medium sized enterprises/value chain actors/public/etc.>, who work in land use type <agriculture/forestry /urban/industry/nature conservation/other>. I <do/do not> have a soil science background. I <do/do not> have a data science background. My digital expertise encompasses <often used software>. I usually use portals <portals/repositories/websites> to find information or data. I want to have/be able to <function>.

For example, additionally: I <do/do not know> where to look for suitable data or knowledge sources. The data sources <list data sources>, and/or these knowledge sources <list knowledge sources> I know are located <webadres>, and accessible through <website/app/api/other>. I <have/have not> used these data before successfully. I would like to use them <in combination with/standalone> other data sources which are <list data sources>, and with other knowledge sources which are <list knowledge sources>.

Or: I would like to find an expert on <>.

Or: I would like to publish my knowledge/data on <>, for user group<>.

Or: I want to get an overview of available knowledge/data or gaps on <> for <geographic scale>, in <timeframe>.

This will then allow me to <business reason>, and not have to do <business reason> which helps me because it is <faster, more efficient, easier, cheaper, legally required, xxx>. A business reason usually includes **acceptance criteria** (also known as `Definition of Done`), they usually can be derived from the business reason of the story. 'Are the business criteria met.'

Background (optional)

The background of an user story give insights on why the user story is created and provides more details that may not be captured in the user story. Mostly this information is too much for the user story itself. You can write down the background of your user story if it helps for creating the user story.

Annex II: Catalogue of Requirements excel sheet v1

Table 8 Catalogue of Requirements

Number	Description	Name	Source	GA Page	Chapter	Deliverable	Component	Type	State	Priority	KoM workshop print

Annex III: Rolling plan excel sheet v1

Table 9 Rolling plan

Item ID number	Insertion date	Item description	Item author	Category	Impact on the SoilWise Repository	Priority	Risk	Risk Mitigation	Responsibility	Notes/Comments	Revision/ Change	Date of revision/change	Reason of revision/change	Proposed implementation	Date of proposed implementation