



SHERPA
Rural Science-Society-Policy
Interfaces

**DELIVERABLE 4.4
SHERPA ONLINE
REPOSITORY DEVELOPMENT
DOCUMENTATION
AND USER MANUAL**

30 SEPTEMBER, 2020



DELIVERABLE 4.4: SHERPA ONLINE REPOSITORY DEVELOPMENT DOCUMENTATION AND USER MANUAL

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Executive Summary

The work documented in this deliverable relates to the development and deployment of the initial version of the SHERPA online repository. The purpose of the SHERPA repository is to enable a broad range of potential users to access information and content pointing to: (i) rural topics addressed and investigated in the context of the Multi-Actor Platforms operating in SHERPA (at both the national/regional and EU levels); (ii) the research projects associated with each rural topic and the outputs produced by them; (iii) results obtained from text-mining and natural Language Processing methods applied to text-based project outputs; and (iv) the papers produced in the SHERPA project (e.g. the SHERPA Discussion and Position papers).

The process of developing the repository will continue through the life cycle of the SHERPA project until a fully-fledged solution is reached by the end of the project. To produce the final version of the repository, a systematic, repository-related revision and update/upgrade process will be implemented starting after the release of the initial, prototype version.

The prototype repository version enables user access to descriptions of two rural topics (namely, the 'Long-term vision for rural areas' and the 'Biodiversity' topics) together with details and information about research projects associated with those topics.

The work related to the development and release of the prototype follows on from the work done and reported in Deliverables 4.2 ('SHERPA online repository design and technical specifications') and 4.3 ('First rural research outcomes retrieval using SHERPA web crawling tool'). The documentation of the prototype version of the SHERPA repository starts with a description of the methodological approach employed (Section 2). The process of the design and revision of the mock-up screens (through to reaching a consensus with regard to the look of the user interface) is described in Section 3. The evolution of the design of the front-end of the repository, is presented through the illustration of the evolution of the mock-up screens through the process of consultation with project partners.

A detailed explanation is provided of all the decisions made regarding the use of specific software solutions and frameworks. Based on that, the design and implementation of the back- and front-end of the repository system are described. Explanations are provided of how the development process has ensured compliance with the FAIR data principles.

Insights are provided on the technological, cloud-based service adopted for the deployment of the SHERPA repository, and the rationale behind it. The documentation of the process of development of the repository concludes with a brief summary of the key parts of the work done and a discussion of the validation- and update-related steps that will follow. Links will be established with other EU-funded research projects undertaking similar developments, as part of the process of development and updates of the SHERPA online repository.

The Annex of the deliverable is the first version of the user manual of the repository. The manual provides information about: (i) the organisational structure of the SHERPA repository (i.e. the hierarchical structure of the repository's pages); and (ii) the interactions supported in terms of the content and information delivery, the actions enabled, and the elements provided for facilitating navigation by the user.



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1. Introduction

The SHERPA project is developing the technological infrastructure to provide an access point to all the SHERPA-related research. This infrastructure will comprise an online repository in which information relevant to the rural topics under investigation will be brought together. Primarily, this information relates to project-related content which can be retrieved from external databases through the crawling process documented in Deliverable 4.3 ('First rural research outcomes retrieval using SHERPA web crawling tool'), and content produced by other tasks in the SHERPA project.

The design and development of the repository is being undertaken to ensure that the system will be robust, with high quality content and the efficient provision of information. This system will be active throughout the project's life cycle, meaning that it will be regularly updated and enhanced to serve user needs as required.

The work presented in this deliverable relates to an initial, prototype version of the SHERPA online repository. It represents the Minimum Viable Product that contains all the predefined features and establishes a strong base for future versions of the repository.

The prototype builds on the work documented in Deliverables D4.2 ('SHERPA online repository design and technical specifications') and D4.3 ('First rural research outcomes retrieval using SHERPA web crawling tool'), from which inputs have been used for the process of design and to inform information architecture.

The work documented in this deliverable builds on that reported in Deliverable D4.3 which described the SHERPA web crawler. The crawler-related details explained in Deliverable 4.3 relate to the identification of research projects from the CORDIS and LIFE programme project databases and their classification as project cases, linked to the 'Long-term vision for rural areas' and 'Biodiversity' topics¹ (and associated subtopics), on the basis of keyword matching². The work presented in this deliverable advances the decisions made in previous tasks, which are described in the deliverables referred to above.

2. Methodology

To develop the 'prototype' version of the SHERPA online repository, a standard methodological approach has been adopted (Figure 1). As in most software product development projects, this follows the Software Development Life Cycle which is made up of six (6) steps. The process employed in each step has been adapted to fit the requirements of the development of the SHERPA online repository, building on tasks which were undertaken previously and reported in the respective deliverables. Further tasks relating to the repository will be undertaken through to the end of the SHERPA project.

1) Planning: The goal of Deliverable 4.2 ('SHERPA online repository design and technical specifications')

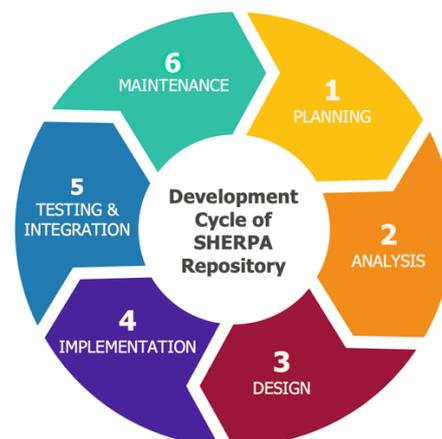


Figure 1: Development Cycle of SHERPA Repository

¹ The 'Long-term vision for rural areas' is the rural topic decided, in the context of SHERPA, to be addressed by the Multi-Actor Platforms operating across Europe and serving the purpose of the SHERPA project's core Science-Policy-Society interfaces concept. The 'Biodiversity' topic has been included as a proof-of-concept.

² The keywords used to identify the research projects relevant to a rural topic have been identified and provided by the project experts.



was to explore the initial requirements of the system in terms of the data necessary, the structure of the data, and the identification of user profiles and needs. Specifically, the issues addressed in that deliverable relate to:

- the description of the data to be stored in the SHERPA online repository;
- the definition of the profiles of the end-user types targeted and their needs;
- the description of the SHERPA online repository system's architecture; and
- the description of the system functionalities and their alignment with end-user types and needs.

2) Analysis: Deliverable 4.3 ('First rural research outcomes retrieval using SHERPA web crawling tool') identified and analysed the outcomes of the crawling process, which are the primary pieces of information, relating to rural-related projects, to be stored in the prototype SHERPA repository. This analysis has facilitated the process of setting objectives, validating the proposed data models, as well as identifying obstacles and potential solutions.

3) Design: The design phase of the SHERPA repository is presented in detail in this document. All the requirements, together with conclusions from the analysis process, have been taken into consideration to define the design specifications and information architecture of the SHERPA online repository. A first set of mock-up views of the application of the repository have been created and evaluated, which provide the basis for the application's development and upgrade through to its final version's release.

4) Implementation: During this phase, the development of the SHERPA repository prototype took place following the requirements and guidelines as defined. The development, which is also described in detail in this document, took place with regard to two distinct components of the application, namely: (i) the back-end, which includes the data normalisation, integration of data in the database, and management; and (ii) the front-end, which includes the user interface and the access points to the database.

5) Testing and Integration: The development of the back-end and front-end parts took place in a testing environment to check for errors, bugs and other issues. During this phase, the infrastructure was checked to ensure that all defects are reported, tracked, fixed, and tested again until meeting the defined quality standards. This phase will be in progress until the end of the project. The prototype repository version, reported in this deliverable, serves as the Minimum Viable Product of the SHERPA repository, which will be updated as the project progresses.

6) Maintenance: The SHERPA repository is a highly dynamic system, which is expected to scale up given that new databases will be explored (e.g. the EIP-AGRI database), new topics added, and information about other projects of relevance will be retrieved in the following months. Based on an appropriately designed evaluation process of this version of the prototype, feedback will be collected with the aim of using it for proceeding to changes and updates necessary before final deployment. Improvements and modifications will involve the addition of new features to provide a repository which delivers high quality content and services in line with its users' needs.

3. The SHERPA online repository development process

3.1. Design of the SHERPA online repository system

3.1.1. Design workflow and timeline

During the design phase, AUA in collaboration with the SHERPA project's WP leaders assembled a group of experts to create, test and evaluate the first mock-up views of the prototype application of the SHERPA repository. The goal was to establish a strong foundation for future versions of the repository system in terms of the information architecture, and the design and principles of its use.



To achieve this, a systematic investigation was undertaken which focused on user needs and the nature of the data crawled in relation to rural topics and projects. The process which was followed was strongly inspired by the Design Thinking methodology^{3,4}, which is quite prominent in a range of fields including digital product design. The design process started with a large number of possible variables and criteria and was narrowed down by clustering and refining them into a structured architecture suitable for the delivery of the information, which had been crawled and integrated into the database (Deliverable 4.3).

During this design process, AUA organised tele-conference sessions with the participation of SHERPA partners listed in Table 1. All partners actively contributed inputs and insights to these sessions.

Table 1: Participants in the mock-up screens design sessions

Participants	Organisation	Area of Expertise
Borja Espejo Garcia	Agricultural University of Athens	Research and education
Spyros Fountas		
Sofia Mouseti		
Hercules Panoutsopoulos		
Olivier Chartier	ECORYS	Economic research and consulting
Elodie Salle		
Enrique Nieto	AEIDL	Coordination and technical assistance in EU projects; Knowledge dissemination; Evaluation of European programmes
Roxana Vilcu		
David Miller	James Hutton Institute	Food, energy and environmental security; Development and promotion of technological and management solutions

The dates of the sessions, the main topics discussed and the outputs produced are summarised in Table 2.

Table 2: The main topics of discussion and the outputs of the design process of mock-up screens

Date of Session	Main Topics of Discussion	Actual Outputs
9/4/2020	<ul style="list-style-type: none"> Initial discussion and planning of the process. Presentation of the first version of the mock-up for the homepage, list of topics, list of projects, project details, SHERPA papers, summary per topic, and summary per project. 	<ul style="list-style-type: none"> Feedback on the first version with regard to the layout, styling, and information architecture. Request for alignment with the official website in terms of design guidelines.
16/4/2020	<ul style="list-style-type: none"> Presentation of the second version of the mock-up screens, after the first 	<ul style="list-style-type: none"> Request for more graphics and attractive layout, inclusion of relevant interactive maps

³ McCarthy, Andrew Peter Wallace (2017). "Design Thinking." *Wirtschaftsinformatik & Management* 9.1, pp. 84-92.

⁴ <https://readings.design/PDF/Tim%20Brown,%20Design%20Thinking.pdf>



	revision process, with enhanced layout and graphics.	in the homepage and a rural topic details page.
21/4/2020	<ul style="list-style-type: none"> • Presentation of the third version mock-up screens, after the second revision, with enhanced layout and graphics aligned with the project's official website. 	<ul style="list-style-type: none"> • Request for clustering of the project list based on the more recently viewed type of results and other options still to be explored.
30/4/2020	<ul style="list-style-type: none"> • Discussion on the list of the upcoming rural topics to be included. 	<ul style="list-style-type: none"> • Planning and finalisation of the repository prototype version in terms of the number of rural topics and project programme databases to be considered.
7/5/2020	<ul style="list-style-type: none"> • Presentation of the fourth version of the mock-up screens incorporating an enhanced project details view. • Discussion on the ranking of the outputs per project. 	<ul style="list-style-type: none"> • Specific guidelines on the ranking algorithm to be developed for sorting the outputs of a project in the project details view.
13/5/2020	<ul style="list-style-type: none"> • Final approval of the mock-ups for the pages of the repository system. • Discussion of information architecture issues regarding the organisation scheme to be adopted for showing the relationships among rural topics, subtopics and keywords. 	<ul style="list-style-type: none"> • Documentation of minor structure details to be revisited in the second version of the repository. • Arrangements on the deployment and domain configuration for the first repository version.

3.1.2. Mock-up screens for the prototype web application

Views of the application have been designed and discussed during the design phase, which will play an important role in the development of subsequent versions of the SHERPA online repository. These views depict issues raised by partners during the design phase, including: (i) a more detailed view of a rural topic; (ii) the presentation of a SHERPA paper; and (iii) options for the clustering of rural topics and the sets of projects, found in project programme databases, associated with the rural topic⁵. Two of these additional views are shown in Figure 6.

Due to the dynamic nature of the SHERPA online repository (e.g. new rural topics to be explored and added, new sets of projects to be retrieved, and more databases to be crawled), these issues will be revisited and the mock-up screens will be updated accordingly.

Figures 2, 3, 4 and 5 illustrate how the design of various repository pages evolved during the course of the interactions held throughout the mock-up screens design process. The timeline of actions held during this process is presented in detail in Table 2. These pages are:

⁵ A detailed discussion of the process of crawling the CORDIS and LIFE databases for projects relating to the 'Long-term Vision for Rural Areas' and 'Biodiversity' topics, their outputs, and the methods employed for their classification according to relevance is provided in Deliverable 4.3 ('First rural research outcomes retrieval using SHERPA web crawling tool').



- i) the repository’s homepage (Figure 2);
- ii) the page displaying the list of the research projects associated with a rural topic (Figure 3);
- iii) the page providing access to project outputs (Figure 4); and
- iv) the repository page for the display of information about a selected rural topic (Figure 5).

The final mock-up screens were selected after the design-feedback-revision iterations held in the mock-up screens design process. They indicate the content and functionalities to be made available by the final version of the SHERPA repository, in its final design. Some features have already been incorporated in the first version of the repository. Gradually, all the features will be integrated in subsequent versions of the repository which will be developed and tested during the course of SHERPA as more rural topics, and associated content, is added.

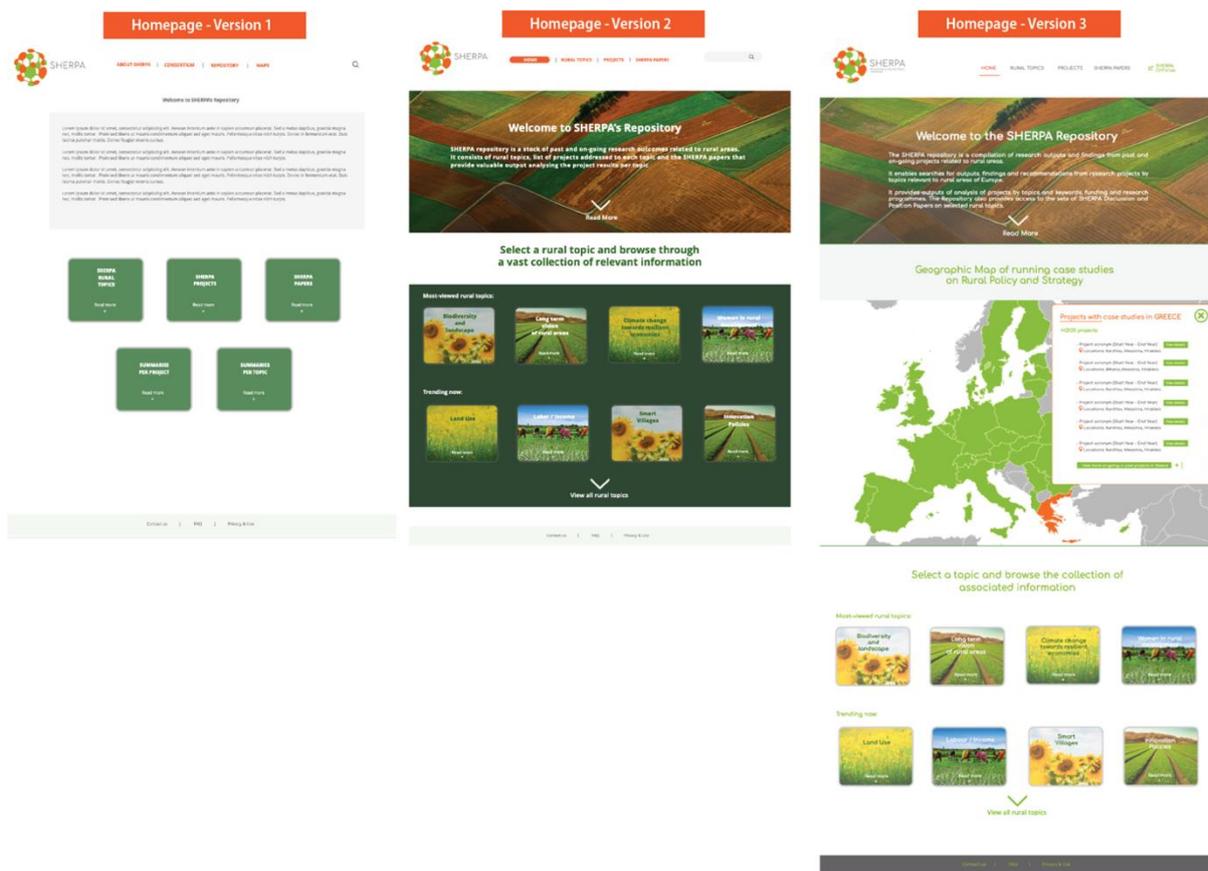


Figure 2: Three versions of the view of the mock-up of the 'homepage' of the application, developed to reflect feedback from partners on each of the mock-up screens version



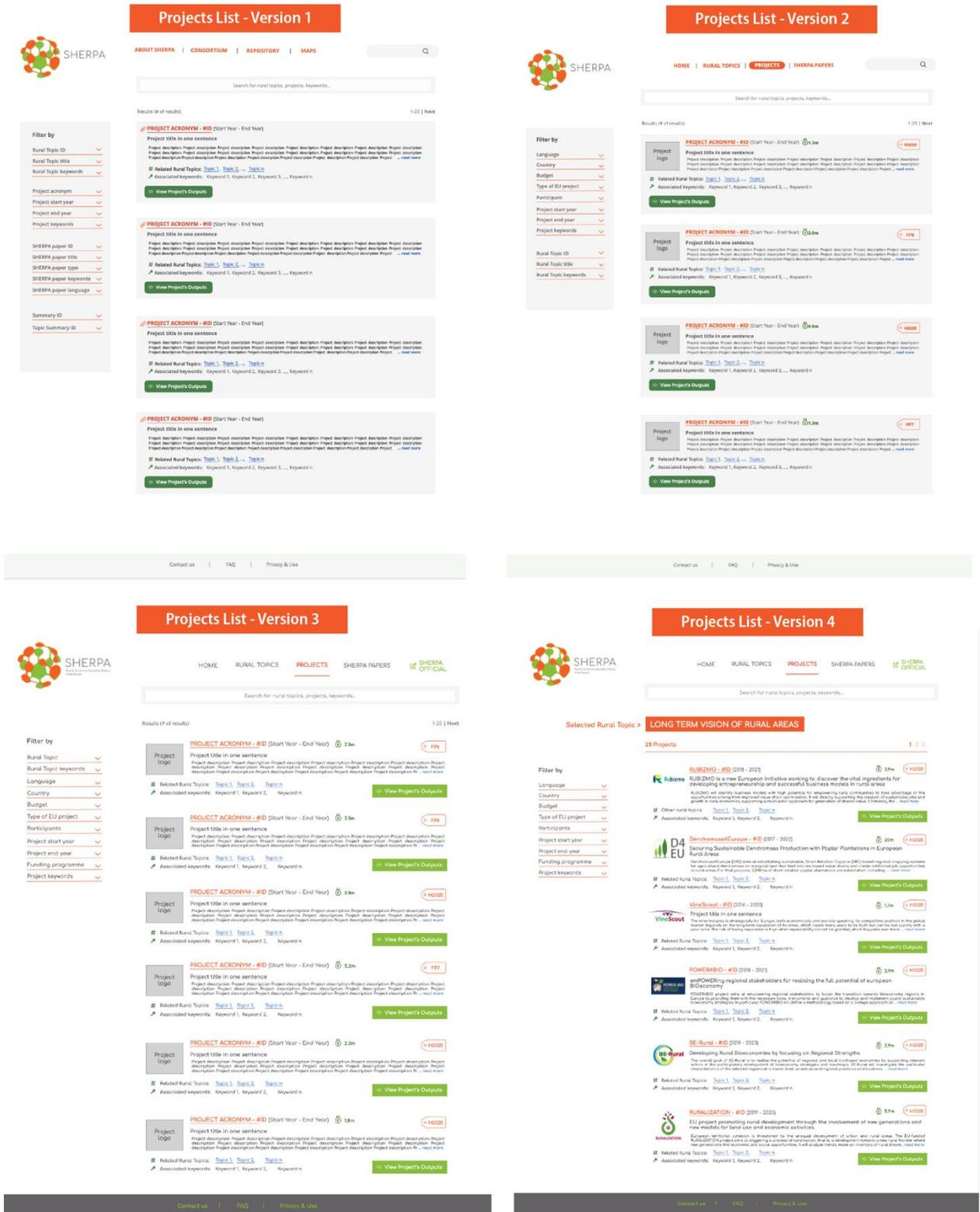


Figure 3: Four versions of the view of the mock-up of the “Project List” of the application. This view presents the projects for each selected topic. The evolution of the mock-ups reflects the feedback from partners and alignment with the style guidelines of the official project website.

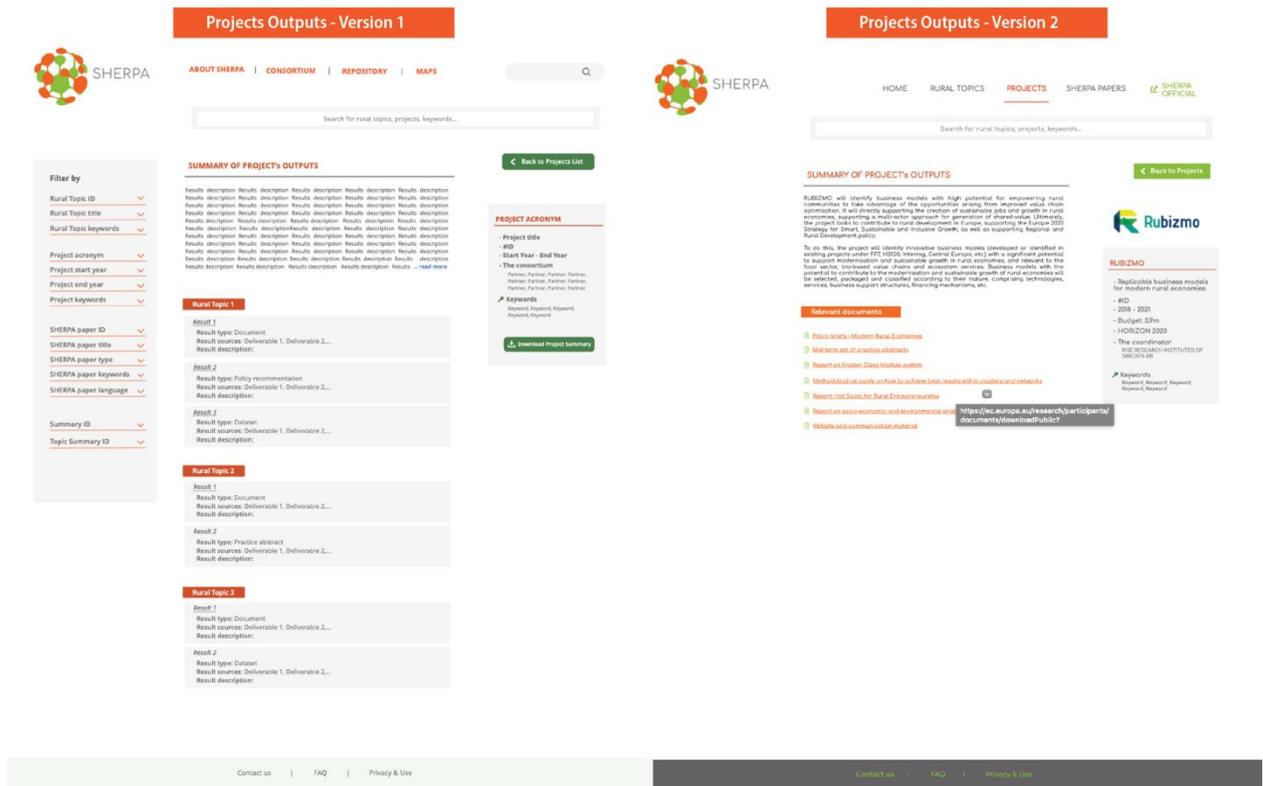


Figure 4: Two versions of the view of the mock-up of “Project’s Outputs” of the application. The version on the right shows an example of an actual, existing, project and all the relevant information and outputs.

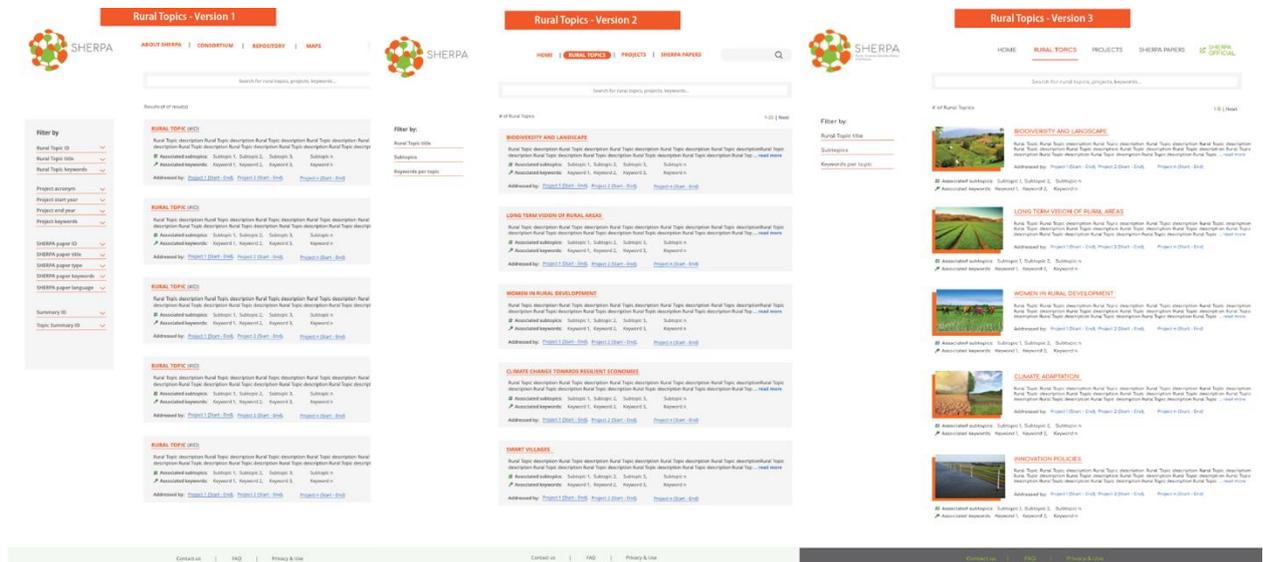


Figure 5: Three versions of the view of the mock-up of “Project’s Outputs” of the application. The presentation of information on this reporting page will be updated as more rural topics are explored in the context of the project.



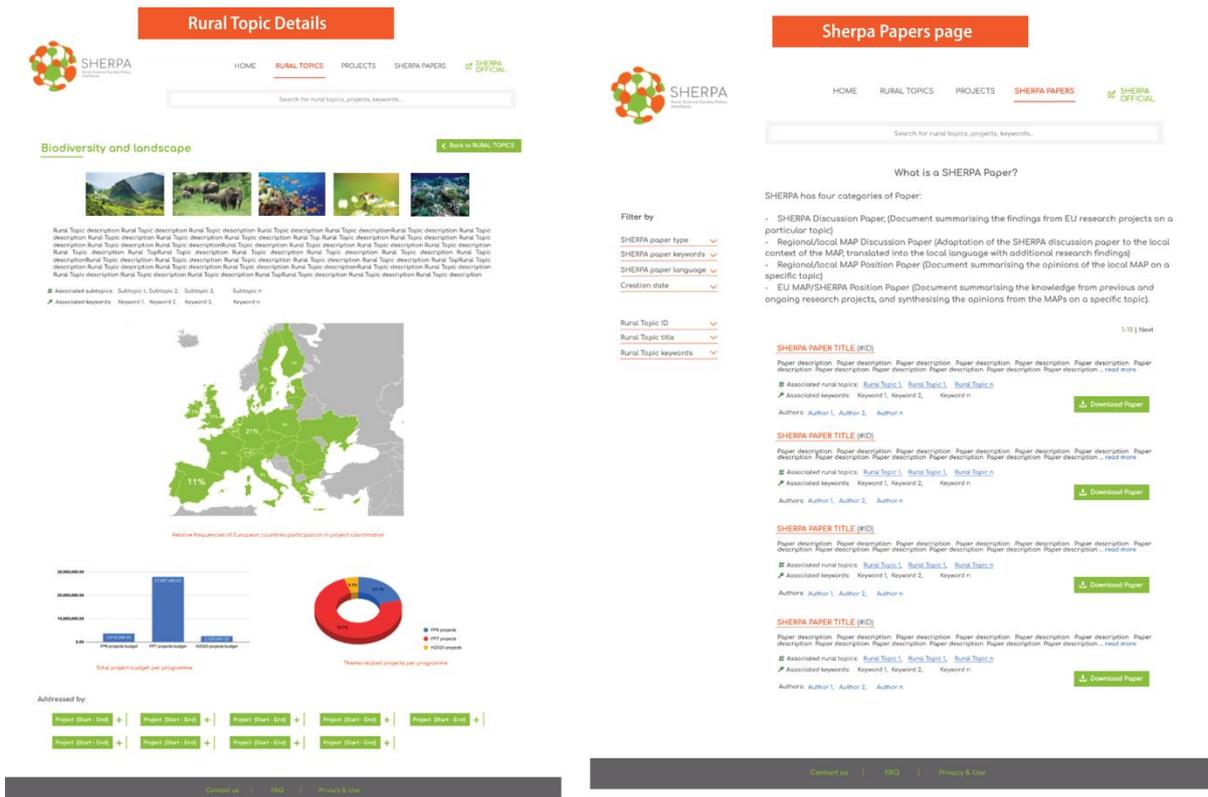


Figure 6: Additional views of the application, not implemented in the prototype version. The left-hand side view shows a detailed view of information for rural topics, with analytics and enhanced media. The right-hand side view shows an initial mock-up of the list of SHERPA papers. This will be integrated in a subsequent version.

3.2. Repository development and technology stack selection

3.2.1. Data quality and FAIR principles

The core of this deliverable is dedicated to the presentation of the SHERPA repository. However, there is an intermediate stage lying between the crawling process (documented in Deliverable 4.3) and the repository system itself. This stage reflects requirement of the SHERPA repository that all project-related information needs to align with the FAIR principles (Wilkinson et al., 2016). This means that the data need to be findable, accessible, interoperable, and reusable (FAIR) to ease its use for further research objectives, and the quality of the data should be sufficient to be shared according to these principles. As shown in Figure 7, after the crawling process, data management steps shape the data to be efficiently delivered through the repository system.

The first step in this process is to validate that there are no gaps in the data delivered by the repository. For example, if the information about the budget of a project is missing, this information gap could generate bugs, as this piece of information is used in the sorting of projects for their presentation. The detection of such issues can lead to improvements of the crawling process, because a new condition is likely to be required for the accurate extraction of information. Projects with which issues are identified with the quality of the inputs are stored in a complementary database for manual inspection to identify why information is missing or wrongly formatted.

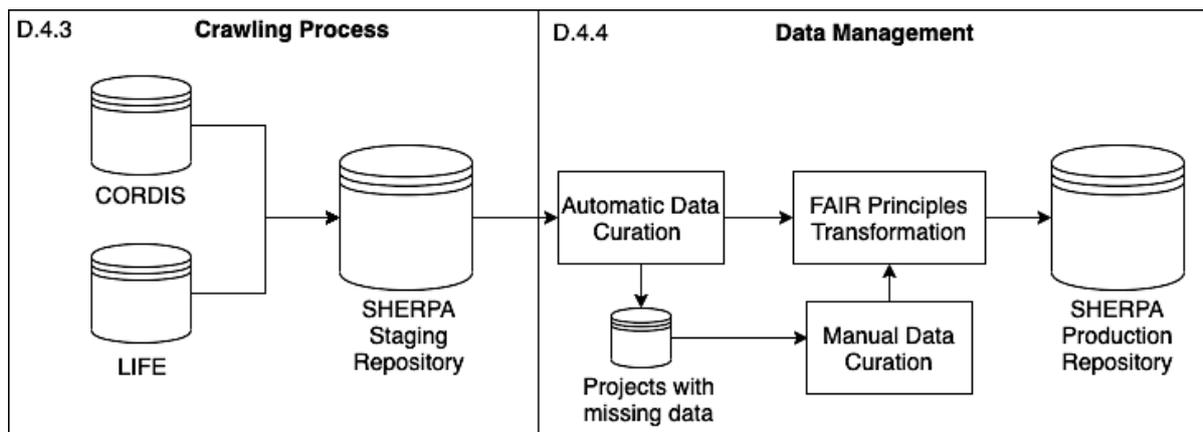


Figure 7: Schema representing the Data Management process between the crawler and the platform

The second and final step in this process focuses on giving the database a set of characteristics that will ensure compliance with the FAIR principles. For example, to make the data findable, some metadata standards such as FOAF⁶ (e.g. Project class⁷) or some data properties from schema.org⁸ (e.g. startDate⁹ and endDate¹⁰) have been used in the implementation of the database. Regarding data accessibility, the database will be accessible through a well-documented REST API, following the guidelines provided by the Web development community. With the design of the repository addressing the first two FAIR principles, the rural project's data can be used in a system other than that of the SHERPA repository.

To enable data interoperability, several data sources are integrated, employing different naming conventions for their metadata. All of these will be addressed with a single schema, which reuses some standard schemas to make data more interoperable.

To make data reusable, a licence will be provided which will comply with all constraints given by the source databases (CORDIS, LIFE, etc.). The best conditions for use of the data in other projects will also be defined. Some licencing schemes such as those provided by the Creative Commons Initiative¹¹ (for example, Creative Commons Public Domain Dedication, Open Data Commons Attribution License, etc.) will be studied in more depth in future stages of the development of the repository.

As in any agile-based software project, the modules implemented within the data management process will be extended iteratively and improved to enhance the quality of data. This will lead to a dataset produced with clean, enriched data, which will be easily reused by future research projects aiming to investigate issues relating to rural policy.

3.2.2. The SHERPA repository web application

Why a framework?

When developing a web application, an important issue to be addressed is the selection of a web framework. Web frameworks are software packages that ease the complexity of web development. They come with many built-in features common to web development, thus standardising the process of construction, and minimising the time required for deploying web applications into production. Most programming languages,

⁶ <http://xmlns.com/foaf/spec/>

⁷ http://xmlns.com/foaf/spec/#term_Project

⁸ <https://schema.org/>

⁹ <https://schema.org/startDate>

¹⁰ <https://schema.org/endDate>

¹¹ <https://help.data.world/hc/en-us/articles/115006114287-Common-license-types-for-datasets>



such as Python¹² or JavaScript¹³, have several web frameworks focused on different developer needs and project requirements.

Why MEAN Stack?

As explained in Deliverable 4.3, the SHERPA crawler has been developed using the Python ecosystem, in which several libraries can be integrated for extracting information from different project websites and storing them in a database. Regarding web development, Python features different web frameworks with Django¹⁴ being one of the most popular. However, this framework does not facilitate the implementation of a full-stack development in which the same programming language (namely, Javascript) can be used for implementing the different parts of the application. This feature can be found in MEAN stack¹⁵.

Although the use of MEAN stack constraints, by default, the adoption of some technologies, other options have been explored to ensure that no important software engineering or related advances have been overlooked in the design choices of the SHERPA system. The main technological components of the MEAN stack framework are divided between the back-end and the front-end (Figure 8).

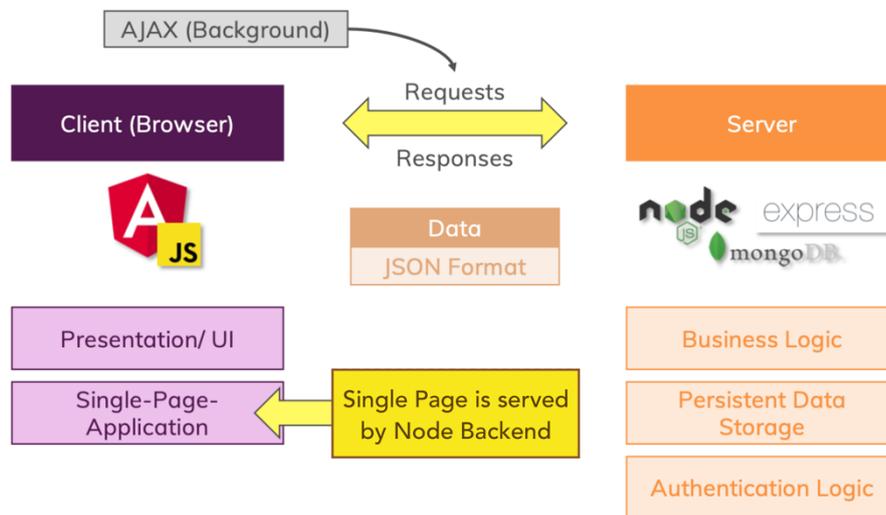


Figure 8: System components and architecture based on the MEAN stack framework

3.2.3. Back-end repository development

The back-end is the part of the system that runs on a remote server and is responsible for executing data-intensive tasks such as the database operations. In the case of SHERPA, the back-end translates the user's requests into database queries which retrieve the required data. It can be divided into two parts, namely the database and the server.

Database: MongoDB

As already discussed in Deliverable 4.3, in recent years, the Internet and the World Wide Web have revolutionised the way data is stored. Due to a number of limitations, traditional Relational Database Management Systems have been replaced by other database systems based on other paradigms (i.e. the NoSQL database systems). Therefore, it was decided that the SHERPA crawler will store information extracted from the various sources into a document-oriented database, namely MongoDB¹⁶.

¹² <https://www.python.org/>

¹³ <https://developer.mozilla.org/es/docs/Web/JavaScript>

¹⁴ <https://www.djangoproject.com/>

¹⁵ <http://meanjs.org/>

¹⁶ <https://www.mongodb.com/>

The same technology has been adopted and used in the production of the SHERPA online repository. There are many reasons for using this database, the most important of which is that MongoDB is the database recommended in the MEAN stack framework. In addition, MongoDB's document-oriented approach provides increased flexibility. This model fits directly into the way developers manipulate data in modern object-oriented languages and, therefore, the maintenance of code is improved. Moreover, with the use of 'documents', there is no need for predefined schemas¹⁷. Without a fixed schema, adding or removing attributes, as new data sources arise, becomes easier. For example, after exploring a new data source, such as the EIP-AGRI database¹⁸, a new project attribute could be found to be relevant for use in filtering results or computing some advanced operations.

In summary, the main advantage of the MongoDB is that it is easier for experimentation by developers, who can try different models without needing to fix the limitations of the schema by implementing ad-hoc solutions on the source code of the server.

Server: Node.js and Express

MEAN stack uses Node.js¹⁹ as the technology for the web server. Its main advantage is that it has fast response times because of its event-driven I/O model that is also non-blocking. Specifically, Node.js has a JavaScript engine that can execute all the code instantaneously without needing to wait for a function to return in order to execute another command. By comparison, some Python/PHP-based alternatives are synchronous due to the multi-threaded blocking I/O approach. With this approach, the application needs to wait for a function to return before proceeding to the next line to execute.

Node.js has an active community with experienced developers to assist new developers with updates and customisation. Node.js has a more vibrant development community compared to other frameworks for back-end development (for instance, Django and Laravel)²⁰.

However, Node.js is a low-level I/O mechanism that has an HTTP module. This means that if the platform runs on the HTTP protocol (as with the SHERPA platform), numerous handling requests which parse the payload and select the right route pattern, based on regular expressions, will have to be implemented. For that reason, in SHERPA (in line with the selection of the MEAN stack) the Express.js²¹ is used for solving this issue. Express.js is a lightweight web application library for use in helping organise the back-end application into a Model-View-Controller architecture, which eases the development and maintainability of the platform.

Another technology, which was not adopted despite its popularity, was Laravel. Laravel is a good choice for relational databases such as MySQL and Maria DB. However, they were rejected due to the flexibility of database model needed in the context of SHERPA. Moreover, as in the case of Django, Laravel does not provide full-stack development.

3.2.4. Front-end repository development

The process of developing the front-end part of the SHERPA repository follows the design process and the results produced, namely the mock-up screens and the database architecture. The ultimate goal of this phase has been to create, test and implement the visual and interactive elements of the repository so as to create the most useful and engaging visual experience for the target users (i.e. advisors, researchers, policy makers, etc.). Development of the front-end focused on the creation of the Graphical User Interface (GUI), which enables access to all the back-end features. The repository's front-end is of increased importance as it is

¹⁷ More details about MongoDB and its data model are provided in Deliverable 4.2 ('SHERPA Online Repository Design and Technical Specifications').

¹⁸ <https://ec.europa.eu/eip/agriculture/en/eip-agri-projects>

¹⁹ <https://nodejs.org/es/>

²⁰ <https://stackshare.io/stackups/laravel-vs-nodejs-vs-django>

²¹ <http://expressjs.com/>



where all the interactions with the user take place. Therefore, the front-end needs to perform very well across browsers, and be responsive in terms of cross-device compatibility.

The front-end development includes the following tools at its core:

- **Hyper Text Mark-up Language (HTML)** has the role of a backbone for the semantic structure of a website.
- **Cascading style sheets (CSS)** for laying out the page and giving it a user-friendly look.
- **JavaScript (JS)** used to transform a static HTML page into a dynamic interface. JS libraries and frameworks used, are jQuery, Angular, React, Backbone, Knockout and others, enabling a variety of visual aids helping transform simple web pages into rich, interactive interfaces.

Regarding JavaScript, all these options have been thoroughly examined in order to select the front-end development framework to be used for the development of the SHERPA repository. The final list of the candidate front-end frameworks was narrowed down to the options listed below:

- [Angular](#) is a TypeScript-based, open-source, front-end platform and framework led by the Angular Team at Google, used for building client-side web applications. Angular is written in TypeScript, which is a superset of JavaScript and used for front-end development.
- [React.js](#) is the front-end framework created and developed by Facebook. The development team was seeking high performance by building an effective UI. One of the simplest frameworks to learn, React, was developed at Facebook to fix issues of maintenance of code due to the constant addition of features to the application. However, it is now an open-source framework. It is recommended for projects that involve the creation of single-page web applications and PWAs.
- [Vue.js](#) is the web framework for building user interfaces. It is an independent tool that creates web interfaces and does not require an additional extension. Vue.js has been created by Evan You and was initially released in February 2014.

Some advantages and disadvantages of the frameworks listed above are described in Table 3.

Table 3: Advantages and disadvantages of three front-end frameworks examined: Angular, React.js, Vue.js

Framework	Advantages	Disadvantages
Angular	<ul style="list-style-type: none"> • The component-based architecture of Angular allows for creation of the GUI with single parts (components) and the reuse these components in the application. • Reduces the amount of code since most of the prominent features, such as two-way data binding, are provided by default. • TypeScript is the core language for Angular, which compiles to JavaScript, thus making the coding process easier due to its improved navigation and refactoring services. • Large community for learning and support. • Angular is a critical component of the MEAN development stack consisting of MongoDB, ExpressJS, Angular, and NodeJS. 	<ul style="list-style-type: none"> • Since Angular is the complete dynamic solution, there are multiple ways to perform a task resulting in a steeper learning curve. • Dynamic applications do not always perform well, because of their complex structure and size. • Complexity: despite its web-based structure, it can be difficult to manage the components. • Learning difficulty: hard to cover the entire bundle of features such as components, modules, dependency injection, etc.



	<ul style="list-style-type: none"> • Angular Material streamlines Material Design interface engineering. 	
React.js	<ul style="list-style-type: none"> • Consistent and seamless performance with the use of virtual DOM. • Reusability of components makes it easy to collaborate and reuse them in other parts of the application. • The stable code is provided by one-direction data flow; direct work with each component requires one-direction data flow and makes the code stable. • React development tools are advanced and very useful. 	<ul style="list-style-type: none"> • Due to multiple and constant updates and innovations in the framework, it is difficult to make the proper documentation which impacts the learning curve. • Hard to understand the complexities of JSX while beginning with the framework. • It only gives front-end solutions.
Vue.js	<ul style="list-style-type: none"> • Clarity and simplicity: it has the smallest API surface and is one of the most lightweight frameworks. • Simple integration and code reusability. Flexibility to design the application structure. • Typescript support. • Browser development tool extensions; does not demand any extra libraries. 	<ul style="list-style-type: none"> • Lack of stability in components, because of the flexibility which leads to code irregularities. • Relatively small community. • Language barrier with plugins and components.

The SHERPA prototype repository is developed as a Single Page Application (SPA) meaning that all the necessary code is downloaded at once, as opposed to multiple page applications that have to request a web page from the server for every hit and load the page requested during use. To achieve this, the Angular framework has been chosen for many reasons, namely:

- Angular is an all-encompassing solution and is an actual framework instead of just a suite of libraries. It is faster, lighter and an easier framework to use, and helps the creation of faster performance applications that are smaller in size and easier to develop.
- Angular augments the performance of browser-based applications by dynamically updating the contents very rapidly due to its use of two-way data binding.
- Angular is universal, meaning that any technology can be used with it for serving the application such as Node.js, .NET, PHP, Ruby on Rails and other servers, enhancing its scalability and compatibility with other applications.
- As the database selected for the SHERPA online repository is MongoDB, it was much easier, for compatibility reasons, to use Angular for the front-end, reflecting its proven benefits as a critical component of the MEAN development stack (consisting of MongoDB, ExpressJS, Angular, and NodeJS as seen in Figure 8).
- The relevant SHERPA partner, AUA, has gained considerable experience using Angular for the front-end development of other web-based platforms, in the context of other EU projects (for example, FAIRshare²²), and internal projects.

²² <https://fairshare-pnf.eu/>



3.3. Repository deployment

3.3.1. Continuous deployment

One of the main concerns when developing any software application is to be able to solve bugs as soon as possible without affecting the rest of the application. This is even more important in the case of a web platform, where the application is fully accessible through the Internet. For that reason, the concept of continuous development and integration has attracted a lot of attention in recent years in software engineering. These practices, which have also been adopted for the needs for development of the SHERPA online repository, result in a more efficient and effective way of upgrading the software without causing any problems relating to service provision.

The most important concept used within this context is 'containerisation', and the most important tool used for this purpose is Docker²³. Containerisation is the approach of running applications on an operating system in which the whole application stack (front-end, back-end, database and operating system) is isolated from the rest of the system. In this way, different applications with different environmental needs can be running in the same operating system and hardware. Additionally, the use of containers leads to avoiding monolithic design approaches and favouring architectures based on microservices (i.e. the latest software engineering trend).

Docker is a tool that enables developers to run, create and manage containers on a single operating system. As a result, complex multi-container deployments are now standardised by the use of Docker. With this, the SHERPA online repository can be subdivided into several microservices, with each microservice being packaged as a Docker container into a specific machine in the case that more storage or computing power may be necessary.

In future, more tools for continuous integration will be considered so as to improve the development process. For example, Kubernetes and Docker Swarm will be explored. Both tools allow the developer to automate container provisioning, networking, load-balancing, security, and scaling across different machines.

3.3.2. Infrastructure

The infrastructure chosen for the SHERPA repository system's deployment is a Digital Ocean Droplet²⁴, which is a Linux-based virtual machine running on top of virtualised hardware. Specifically, the Ubuntu²⁵ operating system is used due to its wide adoption and maturity. Each Droplet can be used as a standalone server or as part of a larger, cloud-based infrastructure. This aligns with the project's technological vision to provide an architecture based on microservices, or services which are as decoupled as possible.

A further important reason for choosing this cloud provider for the deployment of the SHERPA repository is the useful tools it provides for monitoring the repository's performance. An example of this monitoring suite is shown in Figure 9, where bandwidth, CPU usage, and Disk I/O transfer rate can be checked.

²³ <https://www.docker.com/>

²⁴ <https://www.digitalocean.com/products/droplets/>

²⁵ <https://ubuntu.com/>





Figure 9: Monitoring options with the Digital Ocean Droplet used for the SHERPA platform deployment

4. Conclusions and next steps

The work documented in Deliverable 4.4 ('SHERPA Online Repository Development Documentation and User Manual') has focused upon the development and deployment of the first, prototype version of the SHERPA repository. This prototype aims to deliver content and information about rural topics (and more specifically, those already addressed in SHERPA-related research) and the associated research projects.

This process of development and deployment has been based on a standard methodological approach, widely adopted in the context of software engineering projects, starting with the design of the repository system (i.e. static images showing what the system's user interface could potentially look like).

To reach a consensus amongst the design team from project partners, an iterative process has been followed in which the mock-up screens have been created by AUA, brought to discussion to a core group of project partners, commented upon, and then revised. This iterative design process led to final decisions regarding the appearance of the system interface and, thus, was taken into consideration from the development of the first repository version through to release of the final repository (in Month 48).

Development of the repository has been based on software solutions and frameworks that are widely adopted in the software engineering and web development community, with each choice carefully made on the basis of sound theoretical and methodological assumptions. An integral part of the repository's development is compliance with the FAIR data principles enabling, amongst others, the findability and reusability of the information and content available through the repository system.



The release of the prototype version of the SHERPA online repository is the first step in the life cycle of this project output. The repository will need to be upgraded to enable the delivery of more content, provide further functionalities, and cater for the needs of more user types²⁶.

AUA is responsible for providing an update to the repository every twelve months. To do so, a number of well-structured testing and evaluation loops will be used. These loops, planned to start in October 2020, will take place with the participation of representatives of the core project partners (i.e. the SHERPA project's WP leaders).

The repository testers will take part in appropriately designed testing and evaluation sessions in which they will interact with the various versions of the system and provide their feedback in a structured way. This feedback, together with the SHERPA online repository's technical specifications documented in Deliverable 4.2, will inform the development of the final version of the repository in Month 48. The testing and evaluation process will be transparent, with AUA (as leader of the relevant Work Package, 4) providing summary reports of the results and feedback, obtained from each testing and evaluation session, to the project consortium members.

Finally, there is a growing interest in the implementation of initiatives and efforts relating to the development of technological infrastructures with the capacity to integrate content and information from various sources, such as research projects implemented in the context of various project programmes, into centralised repository systems. This interest is evident from other projects also focusing upon this issue, such as the EURAKNOS²⁷ and EUREKA²⁸ projects, as well as initiatives towards the establishment of interoperability standards. The work already undertaken, or in progress, in such projects will be taken into consideration by the work in SHERPA, and links sought with the relevant development teams sought, as part of project aims of the creation of a robust online repository system.

5. References

Brown, Tim (2008). "Design thinking." *Harvard business review* 86.6: 84.

McCarthy, Andrew Peter Wallace (2017). "Design Thinking." *Wirtschaftsinformatik & Management* 9.1, pp. 84-92.

Wilkinson, Mark D., et al. (2016). "The FAIR Guiding Principles for scientific data management and stewardship." *Scientific Data* 3.1, pp. 1-9.

²⁶ A detailed discussion of the complete list of the user types related to the SHERPA online repository is available in Deliverable 4.2 ('SHERPA online repository design and technical specifications').

²⁷ <https://www.euraknos.eu/>

²⁸ <https://h2020eureka.eu/>



6. Annex: SHERPA online repository user manual

This Annex provides all of the information necessary to help a user of the SHERPA online repository make optimal use of the first version of the information system. [The term 'user' refers to any individual, whether a member of a project consortium partner or not, interested in searching for and retrieving information about the rural topics addressed in SHERPA and associated European research projects.]

This section is the SHERPA online repository system user manual. The manual is structured as follows:

- **Sub-section 5.1** ('Structure of the SHERPA online repository') provides an overview of the repository system's structure to facilitate navigation from the side of the user.
- **Sub-section 5.2** ('Interacting with the SHERPA online repository') focuses on each page of the online repository to provide explanations of the user interface and experience with regard to the navigational prompts adopted and the information delivery options.

The SHERPA online repository is an information system providing an 'integrated set of components for collecting, storing, and processing data and for providing information, knowledge, and digital products'²⁹. These two terms are used interchangeably throughout the user manual documentation. The first version of the SHERPA repository can be directly accessed via the URL <http://sherpa-repository.eu/home>. It can also be accessed by selecting the 'SHERPA REPOSITORY' option available in the SHERPA project's website menu, as shown in Figure 10.



Figure 10: Access to the 'SHERPA REPOSITORY' from the SHERPA project's website menu

²⁹ Vladimir Zwass (2016). "Information system". *Britannica.com*



6.1. Structure of the SHERPA online repository

The first version of the SHERPA repository is focused upon the delivery of content and information about two rural topics, namely the 'Long-term vision for rural areas' and 'Biodiversity' topics. The 'Long-term vision for rural areas' topic is the one which being addressed at the time of development of this deliverable. The 'Biodiversity' topic was the pilot study of SHERPA, and been added to the initial version of the repository as a proof-of-concept with the information and content, delivered through the repository.

The content and information available from the repository can be accessed through six online pages (user interfaces) structured as shown in Figure 11. The repository's landing page serves as an 'entry point' to the

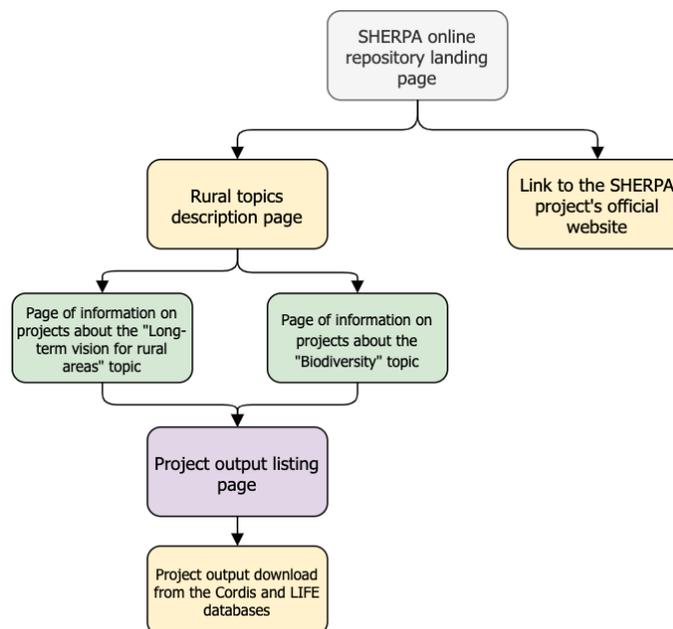


Figure 11: Structure of the SHERPA online repository

information system. From there, the user is able to either visit the 'Rural topics description page' (i.e. the page displaying information about the rural topics already addressed in SHERPA) or the SHERPA project website ('Link to the official SHERPA website').

The 'Rural topics description page' contains links for accessing the repository pages with information about European research projects, retrieved from the CORDIS and LIFE databases, which are associated with each of the rural topics presented in the repository. Use of the navigation prompts embedded in the 'Rural topics description page', the user can view the pages from which information about the projects related to each topic are available. These are: (i) the 'Page of information on projects about the "Long-term vision for rural areas" topic'; and (ii) the 'Page of information on projects about the "Biodiversity" topic'. From each of these pages, and by selecting one of the projects displayed, the user can access a further page containing a list of project outputs. By clicking on the output titles which are highlighted as links, the user can download the respective document from its source database (namely, the CORDIS or LIFE database).

6.2. Interacting with the SHERPA online repository

An overview of each page of the information system is presented with an emphasis on: (i) the information and content made available to the user; (ii) the actions that can be executed; and (iii) the elements used for facilitating the navigation from one repository page to another.

6.2.1. The SHERPA online repository landing page

The 'SHERPA online repository landing page' lies at the top of the repository's structure hierarchy (Figure 12).



Access to contact information and information about the SHERPA project's privacy policy

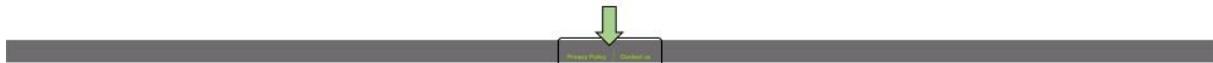


Figure 12: Landing page of the SHERPA online repository

The 'SHERPA online repository landing page' enables access to background information about the SHERPA project and an overview of the rural topics addressed in the context of the project. As the project evolves, more rural topics will be added in the repository's inventory, which will be displayed to the user in various clusters (for example, 'most-viewed rural topics'). The main menu of the repository is at the top right corner of the landing page, which enables the user to navigate the repository pages.

The landing page of the SHERPA online repository can be accessed by clicking the 'HOME' link available in the menu. By clicking the 'SHERPA OFFICIAL' link, the user is redirected to the SHERPA project's official website.

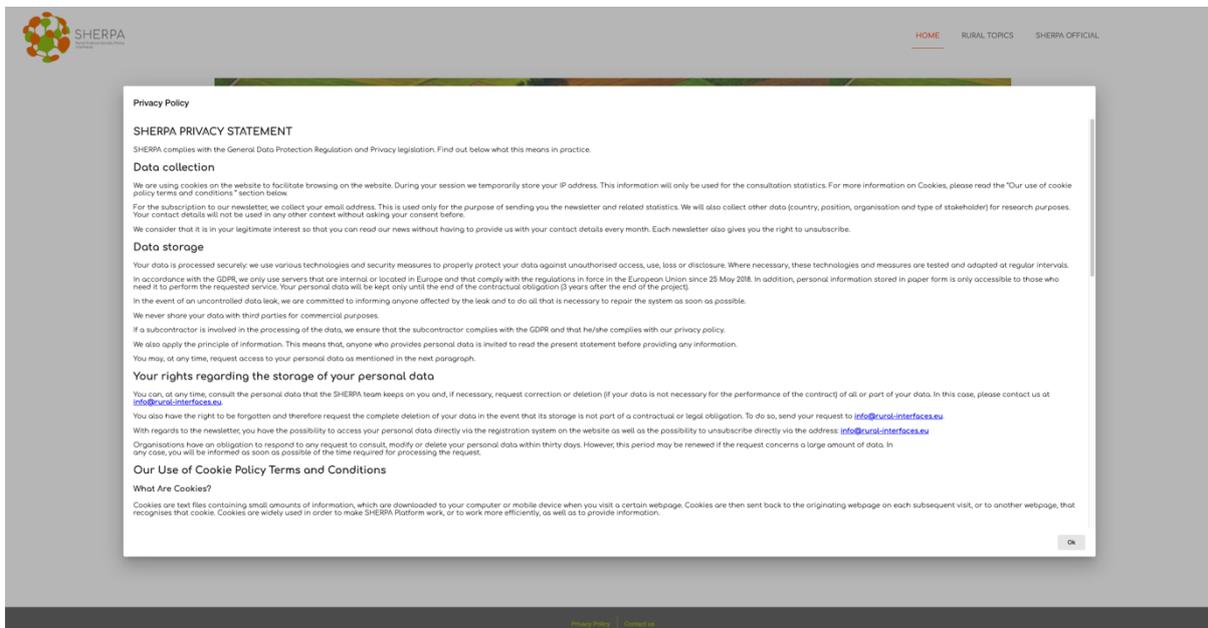


Figure 13: View of access to the SHERPA project's privacy policy terms enabled by clicking the 'Privacy Policy' link

The 'Privacy Policy' link at the bottom of the landing page provides access to information about the privacy policy of the SHERPA project (Figure 13). A mechanism is available to contact representatives of the SHERPA



project, for any project- or repository-related issue, by clicking on the 'Contact us' link. When clicking on this link the email application, used by default by the user's computer, opens to enable the user send an email to the project-related email address (namely, info@rural-interfaces.eu). This functionality is shown in Figure 14.

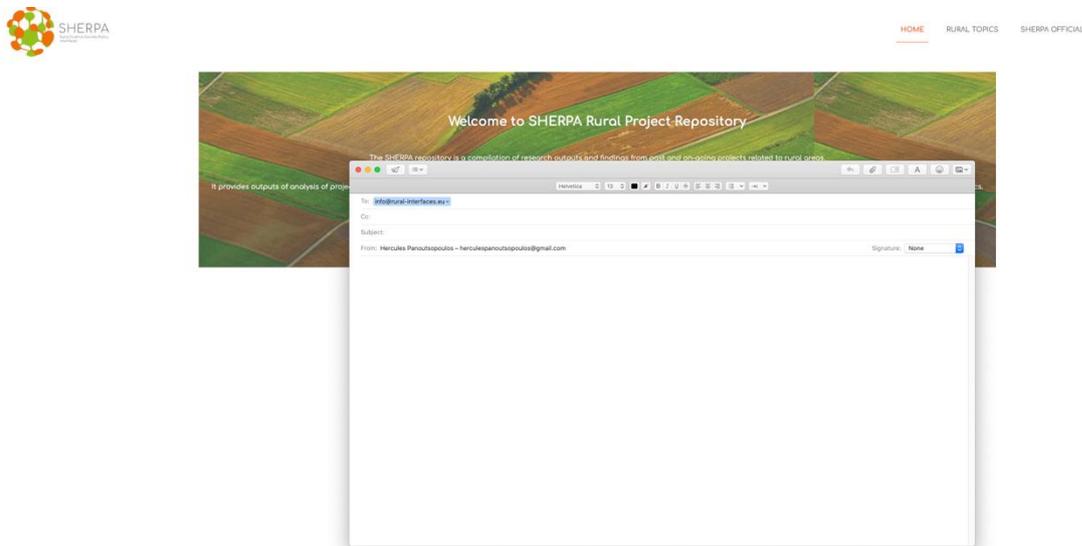


Figure 14: Mechanism for communicating with a representative of SHERPA the project through email, by clicking the 'Contact us' link

The design of the SHERPA online repository fully aligns with the project's visual identity, such as the project logo and colour schemes.

6.2.2. The rural topics description page

The 'Rural topics description page' (Figure 15) of the SHERPA online repository is accessed by clicking the 'RURAL TOPICS' link, available in the main repository menu (at the top right corner of each page). The aim of this page is to provide information about each rural topic addressed in the remit of the SHERPA project. For each topic, the user is provided with the title and a short textual description which includes a number of subtopics into which the topic can be divided. The use of an image that fits the scope of the topic provides a visual aid.

The options available in the repository's main menu enable access to the landing page of the information system or to be redirected to the SHERPA project's official website. In the case the user wants access to more information and content about a rural topic, the 'View relevant projects' button, provided after the end of the descriptions of each rural topic, directs them to the repository page with information about research projects implemented under various project programmes and frameworks³⁰.

The view of information about the privacy policy of the SHERPA project, and the option to contact representatives of the SHERPA project via email, are also available through this page by clicking the 'Privacy Policy' and 'Contact us' links respectively (at the bottom of the 'rural topics description' page).

³⁰ The first version of the SHERPA online repository provides access to projects (and their outputs) available from the CORDIS and LIFE databases.

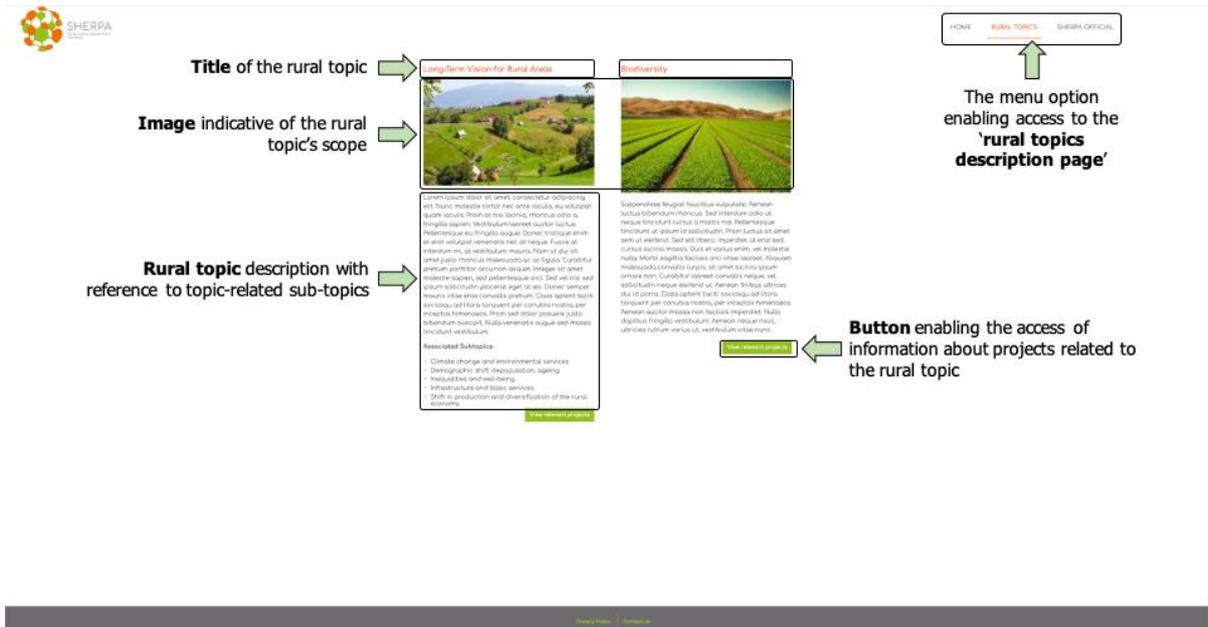


Figure 15: Overview of the 'rural topics' description page'

6.2.3. Pages of information about the research projects related to a rural topic

In the first version of the SHERPA repository, the information about the research projects associated with the rural topics is provided on the 'Page of information on projects about the "Long-term vision for rural areas" topic', and the 'Page of information on projects about the "Biodiversity" topic'. These pages lie at the third level in the structure of the SHERPA online repository (see Figure 11).

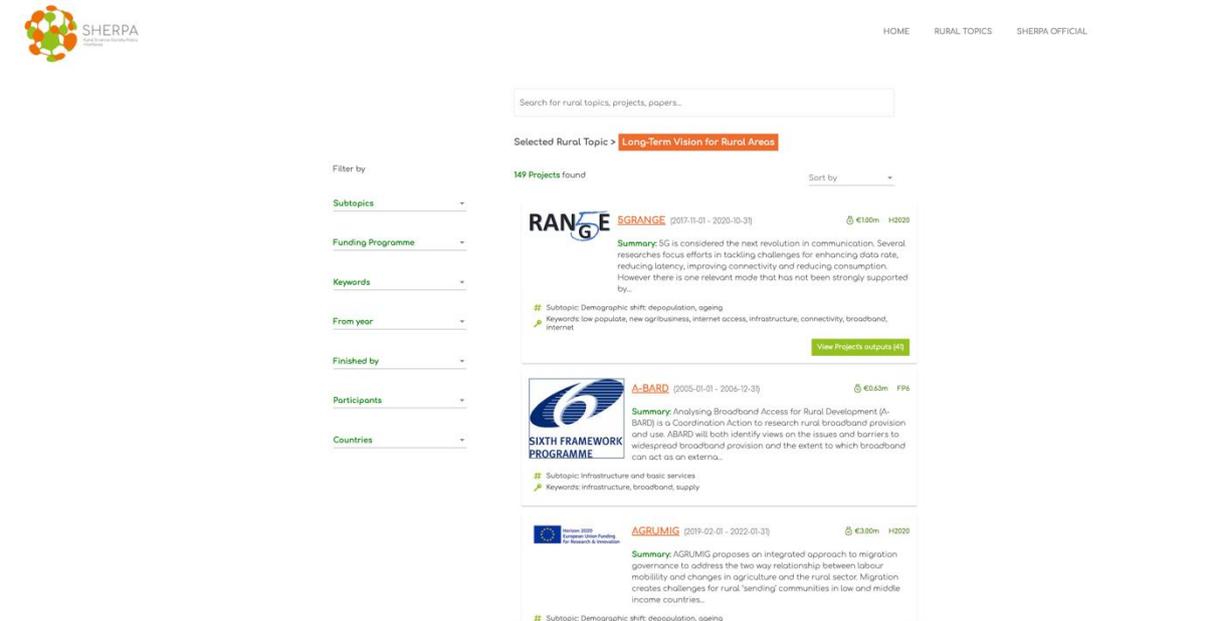


Figure 16: View of the 'Page of information on projects about the "Long-term vision for rural areas" topic'

The 'Biodiversity' topic has been included as a proof-of-concept, reflecting its role as a pilot of the SHERPA process. Therefore, the number of research projects associated with it is limited (ten in total). The 'Page of information on projects about the "Long-term vision for rural areas" topic' and the 'Page of information on projects about the "Biodiversity" topic' are shown in Figures 16 and 17, respectively.



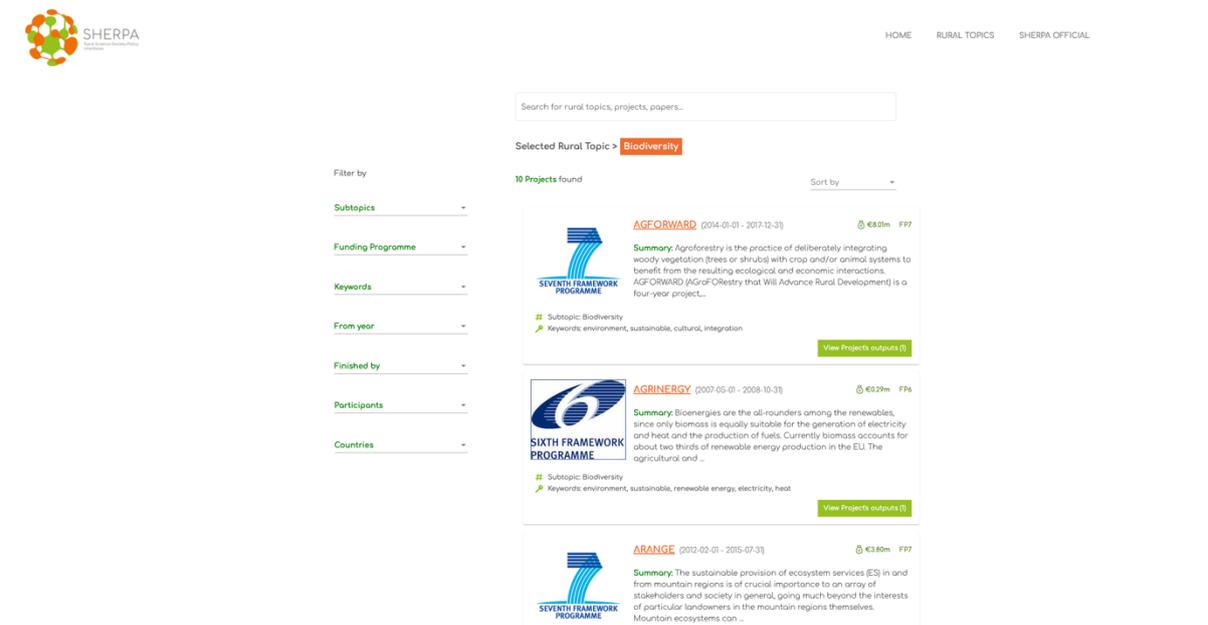


Figure 17: View of a 'Page of information on projects about the "Biodiversity" topic'

Each of the pages with information about the research projects relating to a rural topic comprise the following components: (i) the main repository menu; (ii) a search bar enabling searches for topic-related research projects by making use of one or more keywords; (iii) the topic of the projects displayed; (iv) filters enabling the limiting of the number of the research projects displayed; (v) the number of projects relating to the rural topic; (vi) options for sorting projects associated with the rural topic; (vii) project-related details; and (viii) the SHERPA project logo. These elements are illustrated in Figure 18 and explained below.

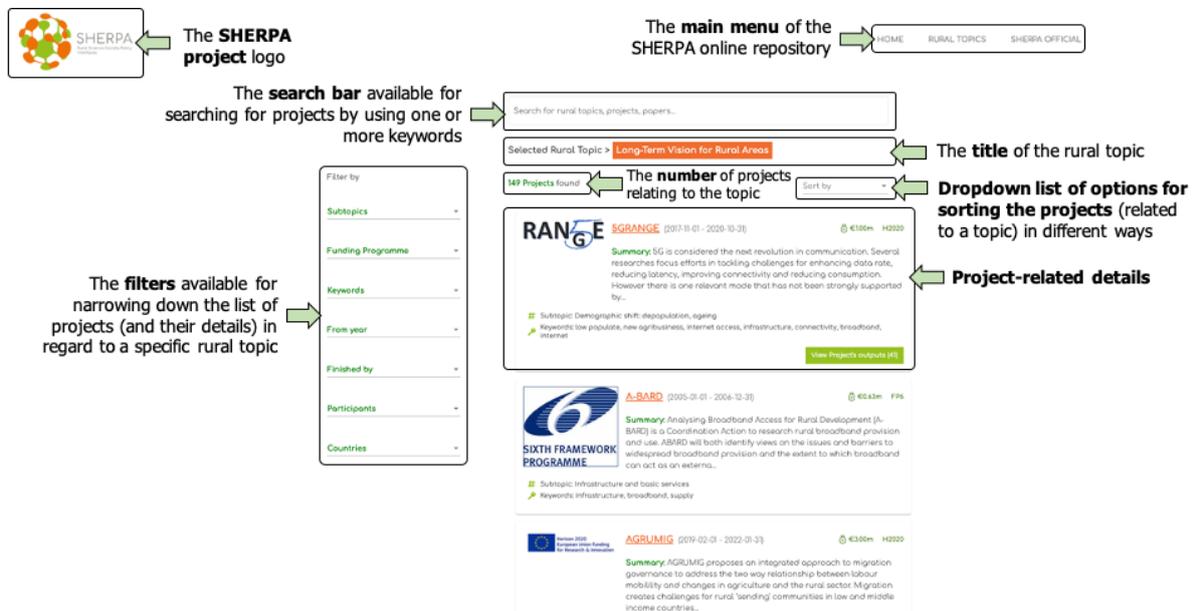


Figure 18: Overview of the structure of a page with information about the research projects related to a rural topic

Search bar

The search bar at the top of the page with the information about research projects relating to a rural topic enables the user to search for relevant projects by entering one or more keywords. In the case of using more than one keyword, these need to be separated by a blank space. After entering the terms that form the

search query, the user presses the 'Enter' key to display the search results. The search bar is illustrated in Figure 19.



Figure 19: The search bar located at the top of the repository page, providing information about the research projects relating to a rural topic

Rural topic title

The title of the rural topic is provided to help the user get a quick overview of that of the projects displayed. The title of the rural topic is displayed in an orange, rectangular box next to the 'Selected Rural Topic >' label (Figure 20).



Figure 20: Information used to acknowledge the rural topic to which the project-related information and details relate

Result number and sorting options

The number of projects, or the number of projects after application of the filtering options, relating to a given topic is reported at the top of the list of the research projects. An example of this information is shown in Figure 21. In addition,

149 Projects found

Figure 21: The number of projects relating to the 'Long-term vision for rural areas' topic

the user can obtain project-related information and details by making use of a number of sorting options. These options can be made available by clicking and opening the 'Sort by' dropdown list (Figure 22).

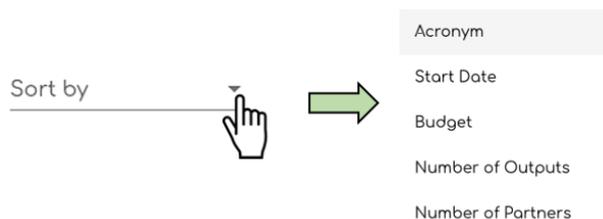


Figure 22: The dropdown list of project sorting options available to the SHERPA repository user

The sorting options provided to the user of the SHERPA online repository are:

- Sorting by project Acronym

Information and details about the projects related to a specific rural topic are listed in alphabetical order based upon the project acronym. For example, 'AGRUMIG' and 'ATTAVIK' are the acronyms of two research projects related to the 'Long-term vision for rural areas' topic. By selecting the 'Acronym' sorting option, the information and details of the 'AGRUMIG' project will be displayed above those of the 'ATTAVIK' project.

- Sorting by Starting Date of the project

In the case of the 'Start Date' sorting option, all the project-related information and details are listed in an order imposed by the date on which the project was officially launched. For example, 'TWISTER' and 'FARMING ECONOMICALLY' are two FP6³¹ projects related to the 'Long-term vision for rural areas' topic. By

³¹ FP6 is the acronym of the **Sixth Framework Programme**, a funding programme created and undertaken by the European Commission, from 2002 to 2006, to support and foster research in the European Union. The budget allocation to FP6 for the duration of the programme was €1.182 billion.



selecting the 'Start Date' sorting option, the information and details of the 'TWISTER' project (officially launched on 01/02/2004) will be provided above those of the 'FARMING ECONOMICALLY' project (launched on 15/10/2004).

- Sorting by project Budget

Sorting project-related information and details by project budgets is in descending order of budget value. For example, 'PREPAIR' is a LIFE project with a budget of 16.63 million euros, whereas 'DataBio' is an H2020 project with a budget of 16.15 million euros. Both projects are associated with the 'Long-term vision for rural areas' topic. When choosing to display project-related information by project budget, the information about the 'PREPAIR' project will be provided before that of 'DataBio'.

- Sorting by the number of Outputs produced by the project

The 'Number of Outputs' sorting option enables the display of projects, linked to a rural topic, starting with those with the greater number of outputs. In the case of projects that are still in progress, the number of outputs corresponds to those already produced and reported in the project programme database (e.g. the CORDIS or LIFE database) from which the project-related information has been retrieved. By using the 'Number of Outputs' sorting option (for example, in the case of the 'Long-term vision for rural areas' topic) the first project displayed is the 'ECOPOTENTIAL' project (ended in 2019) with 179 outputs. The second one is 'SIMRA', an H2020 project with 71 outputs.

- Sorting by the number of Partners involved in the project

The 'Number of Partners' option is based on an approach similar to that of project-related details and information displayed by their 'Number of Outputs'. More specifically, when selecting to list the projects (associated with a rural topic) by the number of partners involved in the project, the project with the greatest number of partners will be displayed first. So, the listing of the 'DataBio' project first, when sorting all the 'Long-term vision for rural areas'-related projects on the basis of their number of partners, means that it has the greatest number of participating organisations.

Project-related details

The SHERPA online repository enables its users to access information and details about research projects that are associated with rural topics. In the first version of the repository, the rural topics to which research projects (and project-related information) are linked are the 'Long-term vision for rural areas' and 'Biodiversity'. The projects associated with these two topics have been retrieved from the CORDIS and LIFE databases. The user can retrieve the following information with regard to a research project:

- Official project logo.
- Project acronym and link to further project-related information.

The project acronym is an active link that redirects the user to the CORDIS or LIFE databases, where further information about the project can be accessed:

- Starting and end date of the project.
- Funding allocated to the project (in million euros).
- Project programme and/or framework in the context of which the project has/is implemented.
- Short textual description of the project scope.
- The topic-related subtopics that are relevant to the project.

Each rural topic is sub-divided into subtopics. In the case of the 'Long-term vision for rural areas' topic, these subtopics are: (i) 'Demographic shift: depopulation, ageing and urbanisation'; (ii) 'Climate change and environmental services'; (iii) 'Change in production and diversification of the rural economy'; (iv)



'Infrastructure and basic services'; (v) 'Rise of digitalisation and smart ruralities'; (vi) 'Inequalities and well-being in rural areas', and (vii) 'Land-use change and competition'.

- Keywords associated with the project.
- A button directing the user to the repository page where the project outputs are listed.

The 'View Project's outputs' button also informs the user about the number of the project-related outputs available. Figure 23 provides an overview of all the project-related information available from the SHERPA repository.

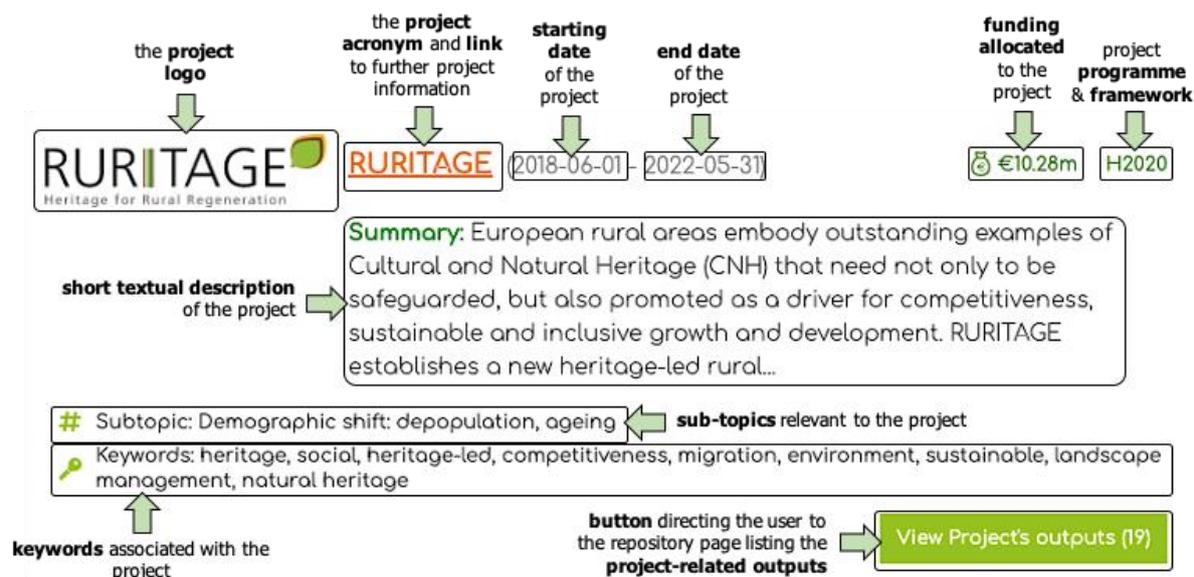


Figure 23: Overview of information about a project made available from the SHERPA repository

Filtering options

The user of the SHERPA online repository can limit the number of project-related results reported to those relevant to a specific topic (e.g. the 'Long-term vision for rural areas' topic). The filtering options available to the user are as follows:

- Subtopics

A rural topic can be sub-divided into subtopics, aiming to make the reporting on the topic to be more specific. The subtopics into which the 'Long-term vision for rural areas' topic is sub-divided are: (i) 'Demographic shift: depopulation, ageing and urbanisation'; (ii) 'Climate change and environmental services'; (iii) 'Change in production and diversification of the rural economy'; (iv) 'Infrastructure and basic services'; (v) 'Rise of digitalisation and smart ruralities'; (vi) 'Inequalities and well-being in rural areas'; and (vii) 'Land-use change and competition'. The subtopic list can be accessed by clicking and opening the 'Subtopics' dropdown list available in the filters list located in the left-hand side of the screen (Figure 24).

When clicking the triangle icon, on the right side of the 'Subtopics' label, the user can view a list of all the topic-related subtopics. By ticking the checkbox on the left side of the subtopic title, the user can limit the number of the topic-related projects and view details and information only relating to the selected subtopic (Figure 24). The user can select more than one subtopic and view the results by ticking the respective checkboxes. The number of results relating to the selected filter value is displayed to the user (e.g. see the '12 projects found' label above the list of the project-related results, Figure 24). In addition, the user can define the way in which the project-related information is ordered by selecting the sorting option of his/her preference from the 'Sort by' dropdown list.



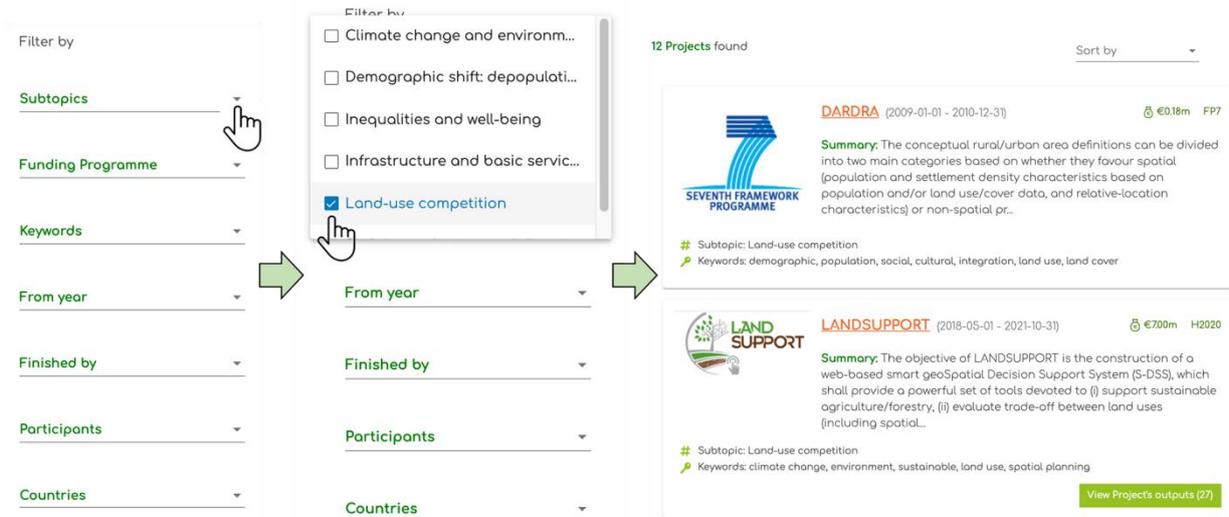


Figure 24: Use of the 'Subtopics' filter option to narrow the number of project-related information provided in the context of a rural topic

- Funding Programme

Filtering can be by funding programme. The options available are: (i) H2020; (ii) FP6; (iii) FP7; and (iv) LIFE. The prototype version of the SHERPA repository enables access only to information and details of research projects harvested from the CORDIS and LIFE databases.

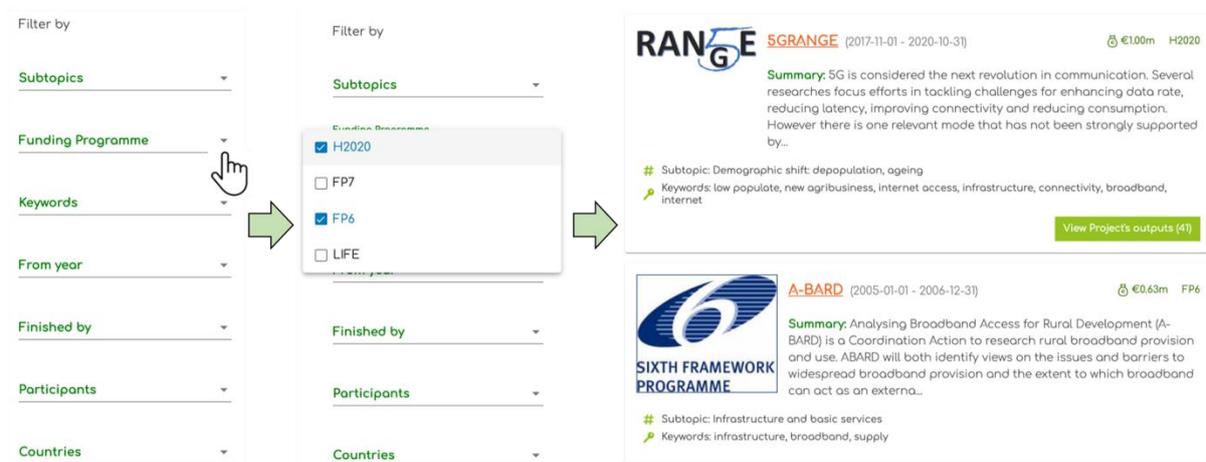


Figure 25: Filtering the project-related results by selecting those funded by the FP6 and H2020 programmes

The application of the filtering values (relating to the 'Funding Programme') is similar to the approach described in the context of the 'Subtopics' filter (i.e. the potential to select one or more filtering values and sort the results in one of the predefined ordering ways). Figure 25 shows the results provided after the application of the 'FP6' and 'H2020' values, comprising information and details about the FP6 and H2020 projects that are associated with the 'Long-term vision for rural areas' topic.

- Keywords

The user can limit the number of the projects displayed by selecting one or more keywords. These keywords are available from the dropdown list that opens when clicking the triangle icon on the right side of the 'Keywords' label. More than one keyword can be selected.

- 'From Year' and 'Finished by'



The number of project-related results can be constrained by setting the start and end years as filters, enabling the information and details about projects (linked to a rural topic) to be specified by specific start or end years. These two filters can be used separately or in a combined mode. Figure 26 shows the results provided when choosing to view details and information about projects that started in 2007 as well as projects that were completed in the year 2011.

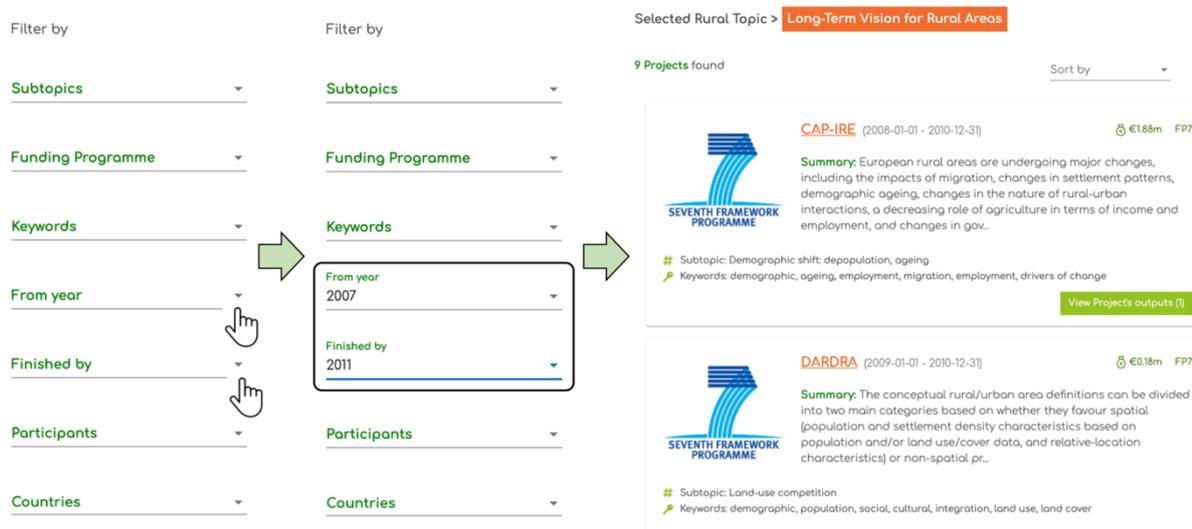


Figure 26: Schematic view of the filtering of project-related results by searching for projects which started in 2007 and completed in 2011

- Participants

The user can view information and details about research projects which are in progress or completed with the participation of specific organisations. The list of the organisations from which to select is accessible by clicking the triangle icon on the right side of the 'Participants' label.

- Countries

The 'Countries' filter is based on an approach similar to that of the 'Participants' filter. The user can view information and details about research projects that have been implemented (or are in progress) with the participation of organisations located in specific countries. The list of countries from which to select is accessible by clicking the triangle icon on the right side of the 'Countries' label.

The user can limit the number of project-related results by selecting and applying the values of more than one filter. For example, the user can select a 'Subtopic' filter to view projects that relate to a specific subtopic, and their associated details, specific funding programmes (through selection of one or more values of the 'Funding Programme' filter), and their year of completion (by selecting a year from the 'Finished by' list).

6.2.4. Project output listing page

The page of the SHERPA repository containing the list of the outputs available from a research project can be accessed by clicking the 'View Project's outputs' button at the bottom right corner of the frame with the project-related information (Figure 27).





RANGE **5GRANGE** (2017-11-01 - 2020-10-31) €1.00m H2020

Summary: 5G is considered the next revolution in communication. Several researches focus efforts in tackling challenges for enhancing data rate, reducing latency, improving connectivity and reducing consumption. However there is one relevant mode that has not been strongly supported by...

Subtopic: Demographic shift: depopulation, ageing

🔑 Keywords: low populate, new agribusiness, internet access, infrastructure, connectivity, broadband, internet

[View Project's outputs \(41\)](#)

Figure 27: The 'View Project's outputs' button enable the user to access the page of the repository which lists the outputs of a research project

The page of outputs from projects provides the following information: (i) a short textual description of the project's objective(s); (ii) details about the project (i.e. project acronym, full name, project start and end dates, project budget and coordinator, and keywords associated with the project); and (iii) the full list of project outputs (Figure 28).

The order of the outputs produced by a project is presented by taking account of two parameters: (i) the date of the output; and (ii) the relevance of the output based on the number of the (sub-)topic keywords with which it is associated. This means that the most recent outputs that contain many of the keywords are ranked highest in the list of project outcomes. However, the calculation of these parameters requires the relevant information to be available from the source databases (in the case of the prototype repository, the CORDIS and LIFE databases). For example, in some LIFE projects, no information is available about the date of creation of some project outputs.

The user can view the entire list of project outputs or a limited set by selecting one or more output types from the dropdown list labelled 'Output Type'. The types of outputs that can be made available from a research project are: 'Brochure'; 'Demonstrators, pilots, prototypes'; 'Documents, reports'; 'Leaflets'; 'Newsletters'; 'Open Research Data Pilots'; 'Project websites'; 'Articles, papers'; 'Books'; 'Case studies'; 'Guidelines, manuals'; 'Reports'; 'Journal papers'; 'Social media'; 'Videos'; 'Patent filed'; and 'Slides, presentations'. The dropdown list containing these output types opens by clicking on the triangle icon on the right side of the 'Output Type' label. This enables the user to select one or more different types of outputs by ticking the checkbox beside each output.

The list of outputs available from a research project is provided below the 'Relevant documents' label. Figure 29 shows the entire list of outputs of the '5GRANGE' project. The titles of some project outputs are available in the form of an active link enabling the redirecting of the user to the CORDIS or LIFE database page from which the relevant output can be downloaded and stored locally on the user's personal computer. There are some project outputs which can be viewed but not downloaded. These are the outputs whose titles are not links directing to a page of an external database.

The repository's main menu (located at the top right of the page) enables access all other pages. The 'Back to projects' button enables the user to return to the page with the information about the projects relating to a specific rural topic.

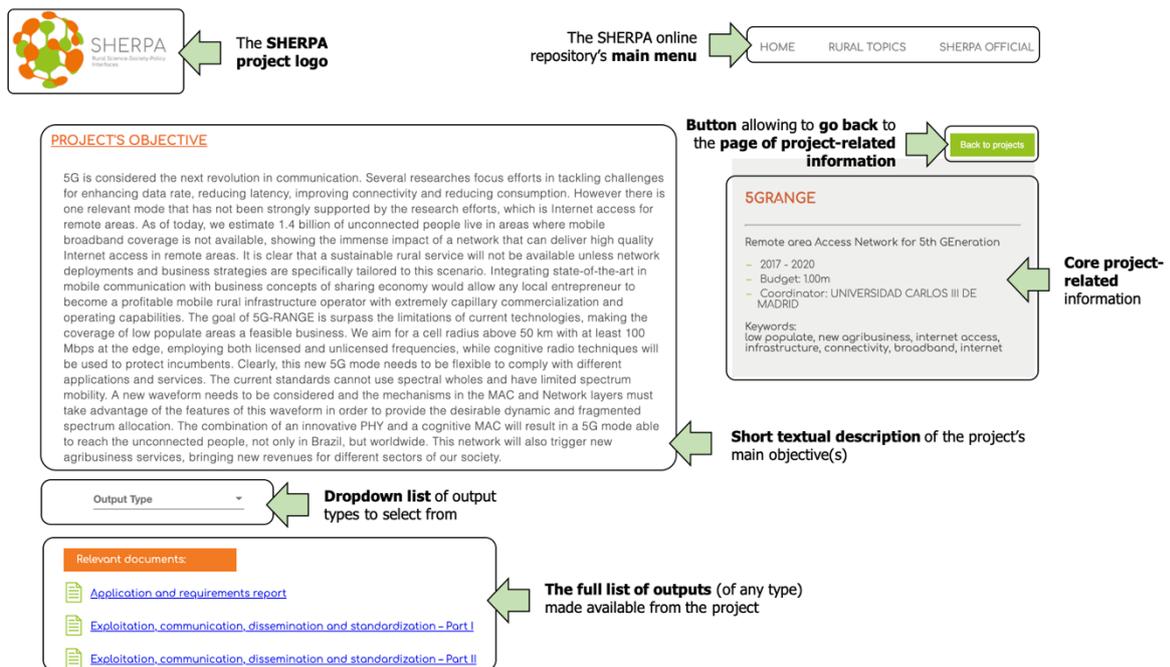


Figure 28: Overview of the repository page listing the outputs of a research project

- Relevant documents:
- [Application and requirements report](#)
 - [Exploitation, communication, dissemination and standardization - Part I](#)
 - [Exploitation, communication, dissemination and standardization - Part II](#)
 - [Report describing the software-based system integration](#)
 - [Dynamic Spectrum Access and Resource Allocation](#)
 - [Initial version of the Network-level Architecture and Procedures](#)
 - [Architecture conception for 5G for Remote Area network](#)
 - [Physical layer of the 5G-RANGE - Part I](#)
 - [Cognitive MAC Layer Simulation Model Development and Evaluation](#)
 - 5G-RANGE Remote area Access Network for 5th Generation
 - 5G-RANGE Project
 - [Physical layer of the 5G-RANGE - Part II](#)
 - 5G for Remote Areas: Challenges and Opportunities
 - Projetos Colaborativos em IoT
 - Missão Técnica Especialistas Brasileiros na Europa
 - "Webinar #6 - INCOBRA sobre O Program Horizonte 2020 (Webinar INCOBRA on the Horizon 2020 Program)"
 - NFV orchestration on intermittently available SUAV platforms: challenges and hurdles
 - 5G for Remote Areas: Field Tests
 - Connectividade e IoT para o Agronegócio (Connectivity and IoT for Agribusiness)
 - 5G-RANGE Remote area Access Network for 5th Generation

Figure 29: Complete list of outputs of the '5GRANGE' project

6.2.5. Link to the SHERPA project's official website

The landing page of the SHERPA online repository enables the user to obtain a rapid overview of the scope and objectives of the SHERPA project, together with the list of the rural topics addressed within its remit. However, if the user requires access to further information about the project, they can be redirected to its official website by selecting the 'SHERPA OFFICIAL' option available in the repository's main menu (Figure 30).



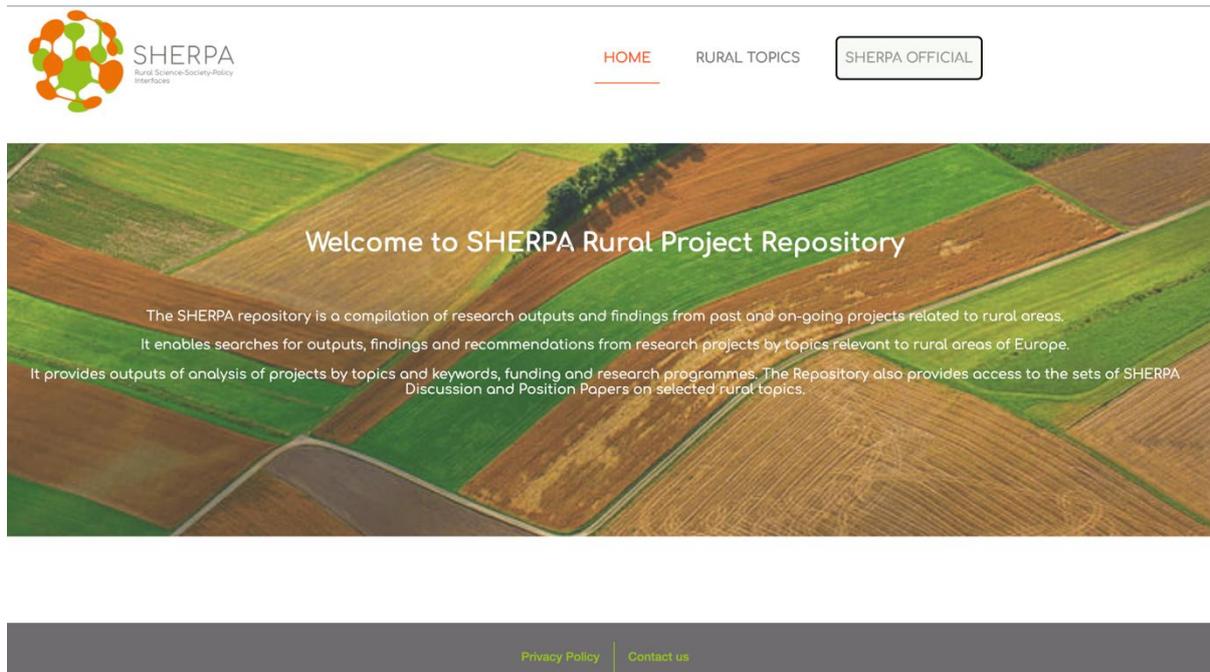


Figure 30: Link from the SHERPA online repository's main menu for re-directing the user to the SHERPA project's official website



SHERPA

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Interfaces