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D7.2 – Innovation platform established

Closing the gap between fork and farm for circular nutrient flows



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List of abbreviations

D	Deliverable
DMP	Data Management Plan
DMT	Data Management Team
GA	Grant Agreement
GDPR	General Data Protection Regulation
GIS	Geographic Information System
IP	Innovation Platform
IPR	Intellectual Property Rights
M	Month of the project
N	Nitrogen
P	Phosphorous
WP	Work Package

1 Executive Summary

This document describes the establishment of the online platform for P2Green, referred to as 'green transition innovation platform' or simply 'P2Green Innovation Platform' (IP), in Deliverable (D) 7.5 led by IGZ as project co-coordinator. AGR as project coordinator and the IGZ together represent P2Green's Data Management Team (DMT), which is responsible for the design and implementation of the IP. Analogous to the initial Data Management Plan (DMP), which was reported in Month (M) 6 in D 7.3 [Bebek, 2023], the conceptualization of the IP is based on a bottom-up process between the DMT and all consortium members. This report contains the identified requirements for the IP, summarizes its conceptualization process and provides an overview of its implementation, so that it can also serve as a guide for future users of the platform.

2 Introduction

2.1 Project background

P2Green is a Horizon Europe Innovation Action with the vision to transform the predominantly linearly organized resource and nutrient system within the agri-food supply chain into a circular material flow system between urban and rural areas. The project uses a holistic approach to restore the coupling of the water-agri-food system following the 3R principle "Reduce, Reuse, Recover". Sustainable food systems are promoted by offering viable alternatives to reduce the current usage of mineral fertilizers with innovative Green bio-based fertilizers and thus minimize the pressure on the natural resources, specifically water and soil. To achieve its objectives, P2Green will develop blueprints as well as new circular governance solutions for the transition from fork to farm to halt and eliminate nitrogen (N) and phosphorous (P), through establishing circular nutrient flows between blue urban and green rural infrastructure. The core of the project is formed by its three pilot regions in Sweden (Gotland), Germany (metropolitan area of Hamburg-Hanover) and Spain (region of Axarquia). In the pilot regions, circular value chains based on innovative solutions for the recovery of N & P from human sanitary waste in urban settlements and their conversion into safe bio-based fertilizers for agricultural production are being implemented and explored. The knowledge and experiences gained in the pilot regions will be used to replicate and upscale P2Green's circular solutions in the four follower regions in Hungary, Italy, France and Greece. To make this possible, a transdisciplinary approach is needed that includes data collection for sustainability assessment (considering agro-ecological, social and economic aspects), business model development, urban planning, legal analysis, creating the governance framework and conducting feasibility studies for replication and upscaling. Furthermore, P2Green aims to enable policy makers to replicate P2Green's sustainable regional circular economy models in all regional settings across Europe. The IP plays a key role in ensuring data management in P2Green and in disseminating the developed Green solutions to the public.

2.2 Aims of the Innovation Platform

The seven Work Packages (WPs) of P2Green cover diverse disciplines, which will generate a multitude of different data sets during the project. For example, this includes technical, agro-environmental, legal, economic/financial, social and geographic data, as well as various blueprints and recommendations for circular N & P flows, business models and governance solutions. The DMT is responsible for ensuring that the data collected in P2Green follows the FAIR principle – i.e. Findable, Accessible, Interoperable and Re-usable. In this context, the IP plays a key role by enabling the storage and sharing of methods and results from the project with both, project partners and external stakeholders. Moreover, following the open science approach, the IP will also serve as a network hub, in which externals from academia, citizens groups, industry and public administration are invited to participate and contribute.

2.3 Core platform functionalities

The IP will ensure effective data management within P2Green, taking into account the individual characteristics of each of the three pilot regions and the diversity of data collected during the project. Based on the need to share data within the project consortium but also with external stakeholders, the IP is divided into two main parts:

- 1) an internal data storage and exchange platform for the consortium members;
- 2) a knowledge repository for external users which are stakeholders interested to learn and apply the solutions developed in P2Green.

In line with the Grant Agreement (GA), the core functionalities of the IP comprise the following points:

- facilitate the sharing of data between project partners through an annotated database (internal);
- store the collected data, set of methods and tools that will emerge during the project lifetime (internal);
- make data and project outcomes available to the public for re-use to foster dissemination and upscaling of the innovative systems solutions (external);
- create a linking hub for the P2Green network, including a repository of relevant stakeholders in the project regions and across the EU (external);
- allow for hosting of methods and tools from other third parties, especially other EU funded projects (external).

To enable the replication and upscaling of P2Green solutions, the IP will remain in operation for 5 years after the end of the project with all of its core functions. In particular, this includes the public hosting of tools for stakeholder engagement, blueprints for circular business models and value chains, recommendations for the governance framework, and a Geographic Information System (GIS)-based replication platform.

2.4 Time plan

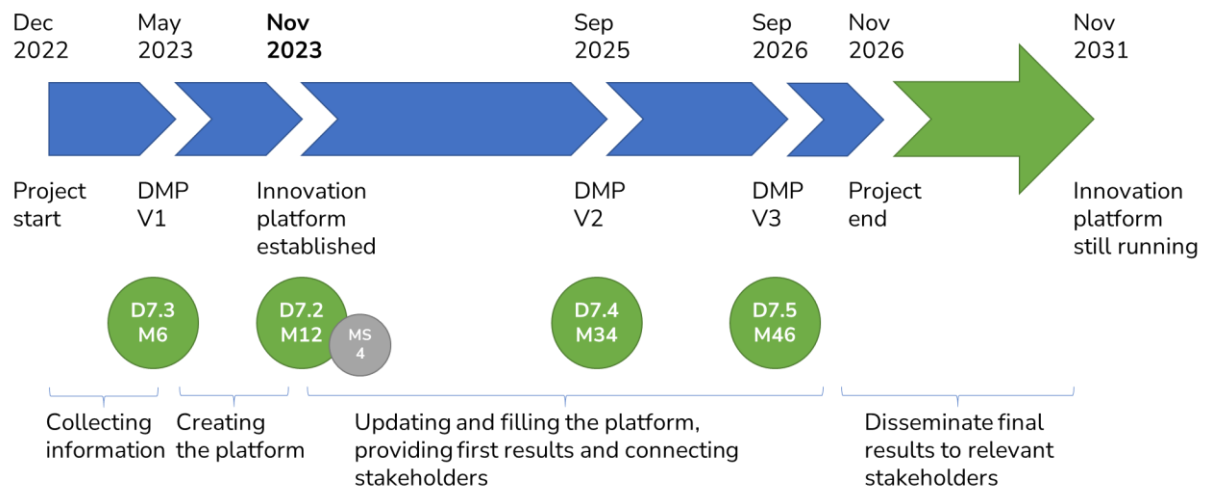


Figure 1: Timeline of the P2GreenN Innovation Platform in relation to the initial Data Management Plan (DMP V1) and its updated versions (DMP V2 and DMP V3).

The IP is being set up for the project lifetime and beyond (Fig. 1). It's initial conceptualization was done on a participatory basis, starting with a dedicated workshop at the project kickoff meeting in M2. During the 25 min workshop, a first overview of data collection needs from the pilot regions was elaborated, taking into account questions and needs from both, senders (i.e. organizations that collect the data) and receivers (i.e. organizations that will use the data for their tasks) of data. This process was continued in more detail at a joint consortium-wide workshop for the DMP and the IP in M4, where also suggestions for a variety of different functionalities were collected from the project partners. A description of the workshop and its outcome is given in Chapter 3.2 below. The results from the workshop were used by the DMT to establish the initial DMP in M6 [Bebek, 2023], and to create a draft document (platform description) on the suggested platform functionalities and structure in M6-M7. After two revisions of the platform description that were needed to adjust the desired functionalities to the existing implementation possibilities, a final version of the document was ready in M9. Details on the IP conceptualization process can be found in Chapter 4. Additional delays occurred during the tendering process for the IP's software development. However, for the project-internal database, the implementation planning has been finalized and is described in Chapter 5.4.2. A first working version of the database is anticipated by M13. The public repository and the P2GreenN stakeholder network will be developed in early 2024, with the IP being fully established by M16 (March 2024). From this date on, the IP will serve as the central hub for storing and exchanging methods and results arising from the project. During the filling phase, further adjustments of the IP will be possible according to the needs of the project partners, which will also be reflected in the updated DMP versions (M34 and M46). This is facilitated by a maintenance and support contract with

the developing software company, which will also ensure the functioning of the platform for five years after the project end.

3 Platform requirements

The IP is aimed at various target groups, from experts in particular areas to various stakeholders in the field of nutrient recycling and the general public. Therefore, the IP will provide a variety of materials adapted to the different target groups, using language and wording that meets the expectations of the readers and thus fulfills the impact objectives of P2Green. The data collected in the project-internal area of the IP will serve the consortium as a source for the creation of documents for the exchange of experience and knowledge with external stakeholders on the public repository of the IP.

3.1 Data types and formats

Due to the heterogeneity of data collected in P2Green, a key requirement of the IP is to handle different types and formats of data. In order to define these, the DMT prepared an Excel file in M3 ('IP Deliverable Overview'), where all project partners were asked to fill in 1) which types and formats of data they collect in a specific Task/Deliverable, 2) which data is needed from other partners from a specific Task/Deliverable, and 3) which data other partners can provide as input for a specific Task/Deliverable. According to this, the Excel file was structured in three parts (Annex, Fig 7-9). In the first part, the participants were asked which input they need from other project partners, which types of data they produce in their Tasks/Deliverables, which data formats they use, if the data can be made publicly available, and which output can be given to other partners (Annex, Fig. 7). In the second part, the partners using the data from another Task/Deliverable ('receivers') were asked which data they need, where the data comes from, and what the requested data format is (Annex, Fig. 8). In the third part, the partners providing data for another Task/Deliverable ('senders') were asked which data they can provide, if this data can be made publicly available, and in which format they will provide the data (Annex, Fig. 9). By using this three-fold matrix in the Excel file, the DMT aimed to verify if the data collection within the consortium matches the requirements to fulfil all Tasks/Deliverables and to identify potential gaps or overlaps (evaluation described in 3.2 below). Fig. 2 includes a graphic evaluation of the consortium's inputs. Further evaluation showed that entries related to the project-internal database mainly included various data and information from the pilot and follower regions collected by WP1, WP2 and WP3. Entries related to the public repository focused on guidelines and recommendations developed by WP3, WP4 and WP5. Overall, no relevant gaps in data collection were identified by the DMT. However, there are some overlaps, meaning that in some cases the same or similar data is collected/used by different tasks. For these cases, templates for data collection have been developed by Task 2.1 (Guidelines and criteria for data acquisition and methodology), in order to avoid redundancy and facilitate a standardized data collection (see 3.3.3 below).



Figure 2: Word Cloud highlighting the most common entries in the IP Deliverable Overview file.

Table 1: Summary of data formats specified in the IP Deliverable Overview file.

<i>Data format</i>	<i>Individual count</i>	<i>Total count</i>
Text	23	31
DOCX	7	
CSV	1	
JPG/pictures	18	30
Figures/graphs	6	
Infographics	4	
“Graphic resumes”	1	
“Illustration”	1	
Excel	17	23
“Numbers”	6	
Map data	5	
MP4/video	4	
PDF	2	
CAD	1	
SPSS	1	

Regarding the data format, three main categories crystallized out: 1) text, 2) image, and 3) Excel/numeric (Table 1). Other categories included GIS-related map files, video files, PDF documents and statistics (SPSS) files. A consolidated list of the data types and

formats that were identified was used as input for creating the technical description of the IP (Chapter 4.2).

3.2 Determination of platform functionalities

To determine if the core functionalities of the IP that were specified in the GA meet the expectations of the consortium and to take into account additional suggestions, a co-creation workshop was organized by the DMT and conducted with the consortium members in M4. In preparation for the workshop, the DMT asked all project partners to rank the main functionalities of the IP according to their perceived importance (1 = most important, 4 = least important). This was the outcome:

- 1) Collecting and sharing data within the project
- 2) Sharing data with project externals
- 3) Hosting methods and tools developed in the project
- 4) Hosting methods and tools from 3rd parties

A Miro board was provided for the workshop, where the project partners were asked to leave sticky notes with suggestions for more detailed functions and features of the IP (Annex, Fig. 10). These inputs were later used by the DMT for concepting the technical description for the IP development (Chapter 4.2).

Functions for the project-internal data collection and sharing included:

- a database with similar data frequency and parameters for all pilot sites
- a common repository for collaboration between project partners
- sharing of standardized data across the WPs
- a stakeholder network hub
- hosting of media content
- image galleries from the pilot regions

Functions for the data sharing with externals included:

- highlighting experiences and blueprints from the pilot regions
- a repository for publishable data
- sharing of knowledge for replication (replication platform)
- hosting a schematic guide for the application of a homogeneous governance framework
- knowledge and technology transfer to relevant stakeholders
- a map where stakeholders from across the EU can be displayed

Functions for hosting methods and tools of the project included:

- implementation similar to data storage
- case studies, guidelines, tools and methods as examples for replication and sustainability

- storing the P2GreeN video app
- support for interested stakeholders on safe and legal circular N & P flows

Functions for hosting methods and tools from 3rd parties included:

- providing developed tools/guidelines and integrated knowledge from 3rd parties to externals for a higher outreach and "real-life" impact
- hosting a database for consultation of networks, stakeholders, best practice, regulations, etc.

Suggestions for features included:

- user-friendly tool for data management and sharing
- easily digestible outputs from workshops and focus groups
- increase visibility to stakeholders by using EU open access repository
- less effort to distribute information by having content in one place rather than sending it individually
- keep the internal, sensitive information separate and private
- effective sharing of tools with externals
- take into account the legacy of the platform

No need for a translation of the IP into other languages was identified. In consequence, the platform will be available in English language only.

3.3 Conformity with DMP and IPR strategy

As a Horizon Europe Innovation Action, the value chains created by the actors in P2GreeN's pilot region (mostly SMEs) are forming the core of the project. However, this entails some important aspects concerning the General Data Protection Regulation (GDPR) and Intellectual Property Rights (IPR). For example, GDPR is relevant for all data that is connected from stakeholders in the pilot regions and later on also from stakeholders in the follower regions. The initial DMP already includes an ethics statement on handling GDPR requirements for questionnaires [Bebek, 2023].

3.3.1 GDPR requirements

Further GDPR-relevant aspects in combination with the IP arise from the collection, processing and storage of personal data. Above all, this includes the creation of the P2GreeN stakeholder hub by Task 5.1 (Development of a P2GreeN network for engagement, outreach and impact) led by CERTH. This task includes the creation of a database of relevant stakeholders ('stakeholder database') from the pilot regions, the follower regions and the EU in general. The stakeholder database will only be available on the project-internal area of the IP. To comply with the GDPR requirements, personal data of stakeholders will only be collected with their agreement. In case the stakeholder database will be made public, it will only contain stakeholder information and contact data that is publicly available such as general (not personalized) email addresses and

phone numbers. Because the stakeholder database will also be used by other tasks (e.g. Task 4.2 – Co-create Strategies to empower and engage local businesses and relevant stakeholders), Task 5.1 in cooperation with Task 2.1 created a template for collecting the stakeholder data that will ensure standardized collection of stakeholder data and compliance with GDPR. In addition to the stakeholder data itself, the Excel-based template includes a column where consortium members can indicate if the contact to specific stakeholders is already established and if so by which project partner. Another GDPR requirement that concerns the IP itself, is the collection of cookies and user information on the website, which will be addressed by including a GDPR statement and a consent form to the cookie policy.

3.3.2 Public and sensitive data

IPR-related aspects mainly include technical data that is collected in the pilot and follower regions such as cost numbers (especially capital/operational expenditure), treatment efficiencies, mass flows and personal hours. Some of this data is considered sensitive as it represents crucial components of the individual partners' business models. Such sensitive data must only be shared with other project partners in order to fulfil their specific tasks like scientific assessments (e.g. Task 2.3 – Impact assessments), business model/value chain development (e.g. Task 3.1 – Investigate and identify the value creation flows between partners to develop a circular business model for local partners collaborating about circular solutions), and replication in the follower regions (e.g. Task 5.2 – Conducting feasibility studies in 4 follower regions). In order to provide the DMT with a first overview, a query of which data is considered as sensitive was also included in the IP Deliverable Overview document that is described in 3.1 above. The rules of data access will be further specified between the DMT and all WP co-leads, which together established a regular data management meeting in M10 that will take place on MS Teams every three months (next meeting in M13). Specific measures for indicating sensitive data were also developed by Task 2.1. In particular, this involves the filling of a mandatory metadata template for each dataset that will be uploaded on the IP's internal database, and which will serve as a 'README' file on the IP (details described in 3.3.3 below). To provide a quick overview for IP users, project partners will have to indicate if data is sensitive during the upload process, so that an indication of data sensitivity is directly displayed on the website when accessing a specific database entry (see Chapter 5.4.2 for more details). The handling of sensitive data will be further described in the IPR strategy (M15) and the mid-term DMP (M34) that are both prepared by AGR and reviewed by IGZ. The DMT will be responsible for the implementation and monitoring of data access during the project.

3.3.3 Data handling and metadata

For the handling of data and its accompanying metadata, Task 2.1 developed specific guidelines and templates as part of D2.1 (Report of common guidelines for methodologies and templates for data collection, M12), which will apply to all data that is uploaded on the IP. Most importantly, when uploading a dataset on the project-internal database, it will

be required to provide all metadata necessary to allow data re-use by others. The metadata template from Task 2.1 will serve as a blueprint for the README file on the IP. However, it is still to be clarified whether the metadata template will be used to manually generate the README file and upload it on the IP or if the metadata entered during the creation of a data entry in the database (see Chapter 5.4.2) will be used to automatically generate the README file on the IP. At the moment, the IGZ explores together with the software developers if all information from the metadata template can be covered by the data entries on the IP.

The metadata template developed by Task 2.1 contains a worksheet (Annex, Fig. 11), where the project partners are asked to specify different metadata (details are presented in D2.1, M12). The filling of the worksheet is assisted by a dropdown menu with a list of pre-defined options where applicable. The metadata template is a living document, which will be updated according to new demands arising during the IP filling phase. To upload the information from the metadata template on the IP as README file, project partners have to export the worksheet as plain text document (CSV or TXT). Briefly, the workflow is as follows:

1. A data file is ready for upload on the IP
2. All required metadata is filled in the metadata template's 'Worksheet' tab
3. The Worksheet tab is saved as CSV or TXT file (using a filename that can be associated with the corresponding data file)
4. The CSV/TXT file is uploaded on the IP together with the corresponding data file

By following this workflow, or alternatively by including all necessary metadata in the data entries of the IP, it will be ensured that the IP contains all relevant metadata to facilitate the re-use of methods and results originating from P2Green. Whether the uploaders should also save a personal copy of the data and metadata files on their own PC/share drive for a certain period for security purposes is still to be determined.

In addition, Task 2.1 also prepared four specific templates for data collection, which will be used to collect data:

- from field trials in the pilot regions (Task 2.2 – Monitoring agroecological impacts);
- for agro-environmental, social and economic impact assessments (Task 2.3);
- for economic/financial data in general (WP cross-cutting theme);
- for the stakeholder database (Task 5.1).

A detailed description of the data collection templates is part of D2.1 (M12).

4 Platform conceptualization

As described in Chapter 2.3, the conceptualization of the IP followed a participatory process including feedback gained from all project partners, especially during the DMP and IP workshop in M4. Some of the IP functions and features that were suggested by

the consortium were not planned initially. Therefore, the DMT had to invest additional efforts into the IP conceptualization, in order to find out if and how the implementation of new functionalities is possible with the budget specified in the GA. This included the identification of possible synergies with other circular economy platforms as well as incorporating the feedback from software developers that were asked for their assessment of implementation efforts and costs by IGZ.

4.1 Evaluation of existing platforms

A range of existing online platforms was collated by the consortium during the DMP and IP workshop in M4 (Annex, Table 2). The platforms were evaluated by the DMT in terms of the included functionalities and contents. An initial idea was also to cooperate with other online platforms to reduce the platform development effort and to achieve a higher impact. However, this proved to be difficult, as the unique requirements of the IP are not fully covered by any of the existing platforms. Many of the platforms considered are either very general, looking at the circular economy as a whole, or very specific, focusing on individual aspects, such as sustainable sanitation. In contrast, the IP needs to serve a variety of different stakeholders involved or interested in circular urban-rural nutrient flows. At the same time, cooperation with other platforms with regard to certain aspects will be actively sought. Possible implementations will be examined during the programming of the IP's public repository.

Despite this, the DMT was able to identify good practice examples for the intended functionalities of the IP. For example, the Hubs4Circularity platform includes a database with different technological solutions that are searchable by keywords, similar to what is planned for P2GreenN's internal database. Another example is the BioRural Toolkit, which includes an interactive stakeholder network map and a public repository for different project results. The latter was identified by the DMT as most promising for finding potential synergies and the contact to the platform developer was established via the project partner CERTH, who is also the coordinator of the BioRural project.

4.2 Obtaining of expert feedback

Based on the requirements specified in the GA and the co-creation workshop in M4 with all consortium members, the DMT drafted a technical description of the IP. The description included some background information on the project and the IP objectives, the requirements of the platform and a detailed platform structure. In the latter, the different types of data, data formats and desired functions/features were indicated separately for the project-internal database and the public repository.

To assess the implementation possibilities of the suggested platform functionalities, the platform description was shared in M7 with a software development company from Warsaw, Poland, which had previously developed the BioRural Toolkit. Additionally, possible synergies with the BioRural platform were examined. However, it turned out that the two platforms are too different in their core functionality to build the IP based on the existing framework of the BioRural Toolkit. Furthermore, the development of all the

suggested functionalities would have significantly exceeded the existing budget, not yet including maintenance and support costs. Therefore, the DMT revised the platform description in M8 and reduced the number of additional functions and features that were classified as 'nice to have' but not essential for the IP.

The revised technical description was also shared with another software development company from Berlin, Germany to obtain a second expert assessment on the implementation possibilities. The software developers also came to the conclusion that the effort and costs of implementing all of the suggested functions and features would be very high. However, also valuable feedback was gained, including various suggestions for a more cost-efficient implementation of IP functionalities.

4.3 Final platform concept

The DMT used the feedback from the software development experts to create a final version of the IP technical description in M9, which was then used by IGZ for initiating the tendering process for the IP development in M10. As a key means to reduce development costs, the integration of the IP's public repository into the existing P2Green website (<https://p2green.eu/>) was identified. This procedure was then agreed with the project partner CIP, who is in charge of the website and responsible for P2Green's visual identity. This also entails that the design of the IP and the public repository in particular will be based on the P2Green website, simplifying the design process.

These were the proposed structure and functionalities of the IP's public repository:

- Short description of the Innovation Platform
- P2Green stakeholder network map (via Google My Maps or similar)
 - Paginated list where different types of stakeholders are displayed
 - Filter for selecting stakeholders by country, type and focus area
 - Sign-up button for external stakeholders to add contact information and a short description
 - GDPR statement and mandatory confirmation by user + optional subscription to the P2Green newsletter → click checkboxes to accept
 - Form to insert stakeholder information (location, type, focus area, short description)
 - Stakeholders appear on the website after approval by P2GreenN coordination, to avoid dubious entries
- Public repository with keyword search and export/download functions
 - >Project factsheets (PDFs)
 - General project factsheet
 - 3 Pilot Regions
 - 4 Technologies
 - Legal situation in Europe
 - >Blueprints for circular N & P flows (PDFs)
 - 3 established regional nutrient cycles
 - Summary of environmental, social and economic impacts

- >Circular business models (PDFs)
 - 3 business models from pilot regions
 - Summary of market assessment and financing options
- >Governance solutions (PDFs)
 - 3 demonstrated and validated governance solutions from pilot regions
 - 4 implemented governance solutions from follower regions
- >Feasibility studies (PDFs)
 - 4 feasibility studies for the follower regions
- >Guidelines and recommendations (PDFs)
 - >Guidelines for replication [examples]
 - Balanced N&P flows
 - Stakeholder engagement
 - Financing pathways
 - >Proposed legal framework
 - >Proposed governance framework
 - >Policy recommendations
 - >Recommendations for other stakeholders [examples]
 - Public administration
 - Citizens
 - Farmers and farmer's associations
 - Sanitation providers
 - Fertiliser producers
- >GIS-based replication platform (developed by P2Green partner IAAC and integrated on the website, e.g. via iFrame)
 - Interactive EU map for replication potential of P2Green solutions
 - Filter functions for the map [examples]
 - N and P amounts from sanitation
 - Recovery potential of P2Green technologies
 - Agricultural demand for N and P
- >P2Green videogame app
 - Short description and pictures
 - Download function for app
- >Publications and data
 - >Scientific publications from the project (PDFs) [examples]
 - Agroecological monitoring
 - LCAs
 - Social acceptance studies
 - Legal analyses
 - >Annotated data sets (XLSX, CSV)
 - >General info material (PDFs)
 - >Project illustrations (PDF, JPEG, PNG)
 - >Project videos (MP4)

These were the proposed structure and functionalities of the IP's project-internal database:

- Central database for all project data with download and export function
 - Text data (TXT, DOCX, PPTX, PDF, CSV)
 - Numerical data (XLSX, CSV, SPV)
 - Cartographic and georeferenced data
 - ArcGISMap templates and documents (MXT, MXD)
 - Shapefiles (SHP)
 - GeoTIFF images (MXT, DIV, TIFF)
 - Image files (PNG, PPTX, PDF, JPEG, TIFF)
 - Video files (MP4, MOV, WMV, AVI, WEBM, HTML5)
- Data upload, update and delete function
 - Browse/drop data file
 - Browse/drop readme file
 - Text input for short description
 - Select keywords [tbd]
 - Select data type [examples]
 - Technical
 - Financial
 - Environmental
 - Social
 - Economic
 - Legal
 - Geographic
 - Select source tags
 - Work package
 - Task/Deliverable
 - Project partner
- Database search form
 - Keywords
 - Data Type
 - Data format
 - Upload date, edit date
 - Source tags
- Output frame for search results (paginated list)
 - Tabular output according to search
 - Filename and link to file
 - Short description
 - Data information
 - Keywords
 - Type
 - Format
 - Upload date
 - Source tags
 - Link to readme file (TXT)

5 Platform implementation

Following the public tendering process in M10, which included the comparison of different offers and a negotiation round, the implementation of the IP started in M11, when the subcontract with the chosen software development company was placed. Because the conceptualization phase of the IP and the tendering process took approximately two months longer than anticipated before, a slight delay resulted in the IP development process. To meet the requirement that the IP is established in its core functionality by M12, the DMT together with the software company decided to start with the development of the project-internal database as the backbone of the IP. The following section describes the current status of the platform development. This process will be continued, with the aim of providing a fully functional version of the IP by March 2024, which is then already adapted to the feedback of project partners.

5.1 Kick-off meeting

An online kick-off meeting was held between the subcontracted software developers, AGR, CIP and IGZ in M11. In the meeting, a concrete time plan for the development of the IP was discussed and agreed by all participants:

- M11: Precise definition of requirements – minimal core functions (“Minimal Viable Product”, MVP) and remaining functions
- M11-M12: Creation of Wireframes of the user interface
- M11-M12: Exact planning and setting up of the hosting by IGZ (app environment, database, web server, file storage, backups, domain and email)
- M12-M13: Implementation of MVP – rollout of application and onboarding of project coordinators as platform admins
- M14-M15: Implementation of remaining functions of the project-internal area
- M14-M15: Coordination between software developers and CIP for implementing the public repository (external area) on the P2Green website, with the support of the software developers
- M16: IP finalization, including feedback from project partners

5.2 Further specifications

For the clarification of requirements, an in-person meeting was held between the software developers and IGZ in M11. As responsible partner for Task 7.5 (Innovation platform and data management), the IGZ will serve as the interface between the P2Green consortium and the software development team. This includes collecting the feedback from project partners on the IP’s implementation and forwarding it in an aggregated form to the software developers, so that the IP functionalities and design can be fit to the consortiums’ requirements.

5.2.1 Database users

The following points were determined regarding the users of the project internal database:

- The maximum number is estimated with 80-100 users during the project time, from which only a small number will be active on the database in parallel
- Database users only include persons belonging to one of the P2Green project partners, each partner organization can have multiple users
- Every user, defined by their first and last name, is assigned to exactly one organization (i.e. project partner), user identification is done by email address
- No other contact data is collected from users, as the project communication takes place outside the platform
- Organizations and users can only be added and managed by admins (i.e. project coordinators)
- Registered users will have access to all entries in the database (view and download), whether users can also edit data from an organization other than their own is still to be determined in consultation with the project partners
- Entries containing sensitive data (i.e. data that should not be published) will be labeled accordingly

5.2.2 Data query

Instead of a free text search, the data can be filtered according to predefined characteristics. These include general data categories, specific data tags and source tags.

Data categories:

- Every data entry is assigned to exactly one data category by the entry creator
- There are no sub-categories, data tags are used for more detailed classification
- Categories can only be created, changed and deleted by admins
- Deletion of a category is only possible if no data entries are assigned to it (entries need to be assigned to another category, before the category can be deleted)
- At the moment, there are 13 different data categories foreseen, which are described in D2.1 and included in the metadata template

Data tags:

- Every data entry can have multiple data tags to classify data in more detail
- Data tags can only be created, changed and deleted by admins
- Users can assign tags to their own data only
- The number of data tags is not defined and will be updated during the project, there are around 100 suggestions currently (D2.1, metadata template)
- It is suggested that data tags remain independent of categories, unless this is explicitly requested by users

Source tags:

- Source tags are used to assign a data entry to a specific WP and Task (two level categorization with WP as main tag and Task as sub-tag)
- Every data entry is assigned to a specific WP and Task
- Source tags are independent of data categories and data tags
- The list of WPs and Tasks is only managed by admins
- The organization of the user creating the entry is automatically displayed (no tag required)

The filter types on the search mask include WP, Task, data category and data tag. One entry can be selected for each filter type (e.g. one WP or one category) and several filter types can be combined (e.g. one Task + one data category + one data tag) at the same time. More complex filters (selection of multiple entries in one filter type) are not foreseen at the moment but may be implemented later depending on user demand.

5.3 Platform hosting

The hosting of the project-internal database as backend of the IP is done by the IGZ as project co-coordinator and responsible organization for Task 7.5. An image of the database developed by the software company is embedded on IGZ's servers and currently tested. For data storage on the IP, the IGZ has reserved 10 TB of its server capacity. At the moment, the estimated volume of data generated during P2Green is well below 1 TB. However, the generated data volume may increase during project, depending on the start of data-intensive tasks such as the development of the GIS-based replication platform by the project partner IAAC. IGZ is therefore planning to conduct a survey on the expected data volumes in the P2Green consortium in order to obtain more precise information before the IP development is finalized.

Once the implementation and testing is finished, the hosting of the database will be done under a sub-domain at IGZ using the following URL: <https://p2green.igzev.de>

The URL of the project-internal area will also be linked on the project website, containing the public repository, so that all parts of the IP are accessible from one URL (<https://p2green.eu/>).

As the server administrator, the IGZ will make regular backups (weekly/monthly) of the uploaded data and store these backups for one year in compliance with data protection guidelines. The software developers will maintain and support the functioning of the IP until five years after the project end.

5.4 User interface

The user interface of the project-internal database will be optimized for desktop PCs and notebooks. Based on a survey during the consortium meeting in M11, there is no need for a smartphone adaptation.

5.4.1 Authentication

In order to prevent the access of unauthorized persons, i.e. all persons who are not a P2GreenN consortium member, the users of the project-internal database have to authenticate themselves using the login form on the database's home page (Fig. 3). The login will be possible using the project partner's email address and a password that is created during the first login process. The authorization of new users is done by the project coordinators (primarily IGZ) by adding a new user with their name, email address and organizational affiliation. The new user will then receive an email from a dedicated email address on the IGZ email server with an invitation link and instructions for the first login. In case that a user cannot retrieve their password, there will be the option to reset the password and generate a password restoration link by clicking on the field "Forgot password?". No registration or login will be required for the IP's public repository, which will later be accessible on the project website.

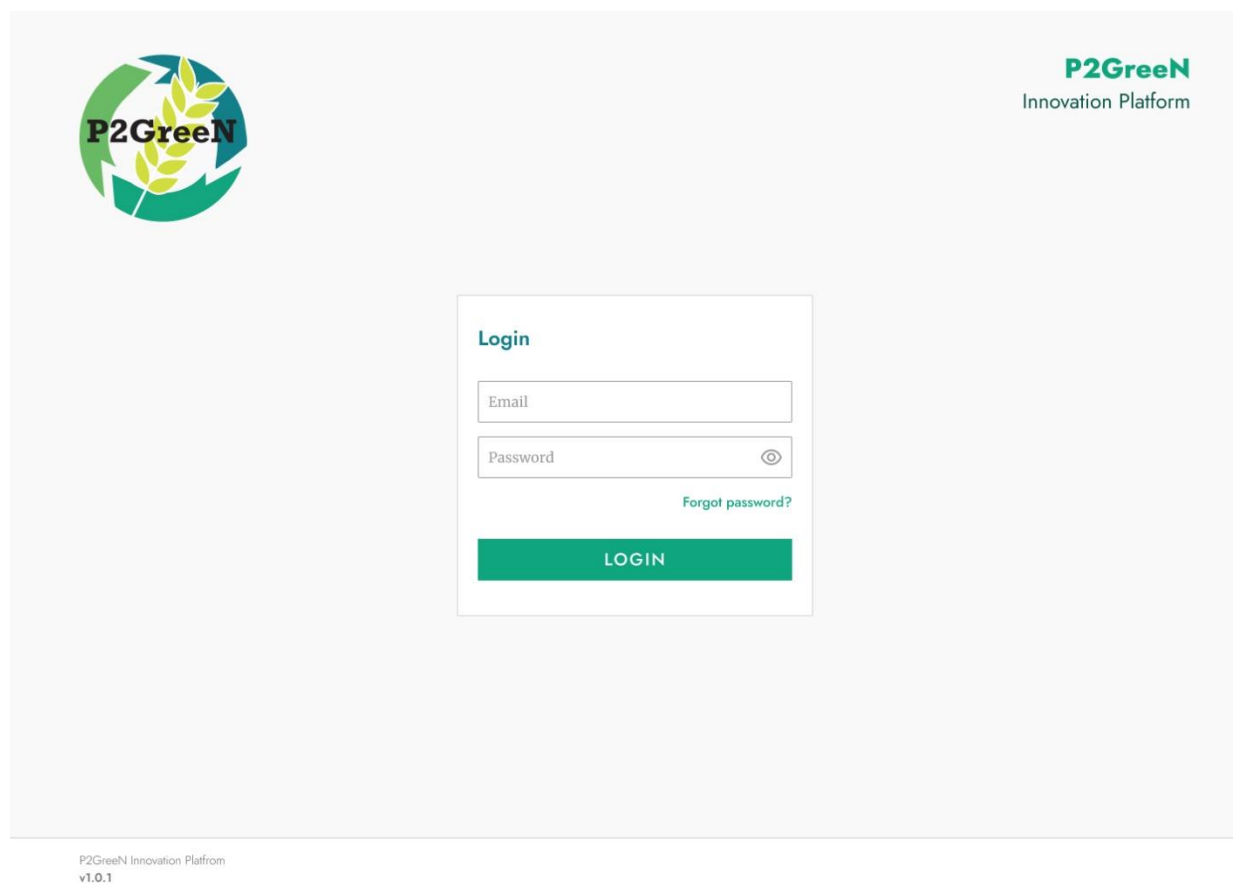


Figure 3: Login page to the IP's project-internal database.

5.4.2 Project-internal database

Directly after the login, users will find a dashboard with the most important functions of the database (Fig. 4). This includes a search mask for filtering existing data entries

according to category, origin (WP and Task), data format and tags. In addition, the results can be limited to entries from the user's own organization, allowing to quickly find entries that the user wants to edit or delete.

The screenshot shows the 'DATA DASHBOARD' interface. At the top left is the P2GreenN logo. At the top right, it says 'Hello Stefan!' with a user profile icon and the email '5410dbf@p2green.com'. Below the header are several filter sections: 'Category' (Choose a category), 'Work Package' (Choose a work package), 'Task' (Choose a task), and 'Data Format' (Choose a format). There is also a 'Tag' search box with 'Choose tags' and a radio button for 'My organisation's entries only'. A 'Reset Filters' button is on the right. A green button with a plus icon says 'CREATE A NEW ENTRY'. Below these is a table with columns: Name, Category, Tags, Work Package, Task, Format, and Modified Date. The table contains 10 rows of data, each with a 'Name' field, a 'Category' of 'Technical', a 'Tags' field with three tags (Tag 1, Tag 2, Tag 3) and a '+2' icon, a 'Work Package' of 'Work package 1', a 'Task' of 'Task 1', a 'Format' of 'CSV', and a 'Modified Date' of '24.10.2023'. At the bottom right of the table, there is a 'Rows per page' dropdown set to '10', and a pagination indicator '1-5 of 5' with navigation arrows.

P2GreenN Innovation Platform
v1.0.1

Figure 4: Dashboard of project-internal database directly showing a list of recently modified files after login.

The results list can be sorted in ascending or descending order according to the last modification date (up and down arrows), e.g. to quickly see which entries were added or updated last. If no filters are selected, the latest entries are displayed in the list. For the

other columns in the results list, alphabetic sorting will be possible using the up and down arrows. Clicking on “Reset Filters” will remove all filters that were applied. The filters shown in Fig. 4 represent a starting point and can be extended if a specific need is identified by the users. Results can be accessed by clicking on a specific entry (described below).

The screenshot shows a web form for uploading data files and metadata. At the top left is the P2GreenN logo. At the top right, it says "Hello Stefan!" with a user profile icon and the email "5410dbf@p2green.com". Below this is a message: "Please fill in the form below and upload the data and README files to create a new entry." The form is titled "Fill in the form" and contains several input fields: "Entry Name" (text input), "Category" (dropdown), "Tags (optional)" (dropdown), "Work Package" (dropdown), "Task" (dropdown), and "Description (optional)" (text area). Below the form are two upload sections: "Upload data file" and "Upload README file". Each section has a dashed box with a file icon and the text "Drag & drop or Choose [File/README] to upload". Below these are "Uploading..." progress indicators and file names: "your-file-here.PDF" and "your-txt-here.TXT". At the bottom are "BACK" and "CREATE" buttons.

Figure 5: Form for uploading data files and corresponding metadata.

New data files can be uploaded from the dashboard by clicking the button “CREATE NEW ENTRY”. This opens a form for uploading data and corresponding README files (Fig. 5). There are mandatory and optional fields to be filled by the user while uploading the data. Mandatory fields include a free text field for a short entry name, a list to choose the data category, and two lists to choose the WP and task for which the user created the data. Optional fields include a free-text description and the selection of one or more data tags. Finally, the data and README files can be added by “drag & drop” or selecting the path on the user’s PC.

The screenshot displays a user interface for managing database entries. At the top left is the P2GreenN logo. At the top right, the user is greeted as 'Hello Stefan!' with the email '5410dbf@p2green.com' and a profile icon. Below this, there are 'Delete' and 'Edit' buttons. The main form contains the following fields:

- Entry Name:** A text input field with the placeholder 'Entry Name'.
- Category:** A dropdown menu currently set to 'Technical'.
- Work Package:** A dropdown menu currently set to 'Work Package 1'.
- Task:** A dropdown menu currently set to 'Task 1'.
- Description:** A text area containing placeholder text: 'Lorem ipsum dolor sit amet consectetur. Eget tellus ullamcorper in interdum. Sed nibh sodales gravida nunc eget nisi. Ornare blandit ac nunc id viverra. Enim nibh convallis vitae felis. Odio pellentesque varius nisi a ultrices lorem amet ipsum. Volutpat aliquam proin ornare justo et netus felis erat. Egestas sapien non amet diam nibh aenean dictum erat. Nisi sed nisl tellus amet id eleifend.'
- Data File:** A file upload field containing 'your-file-here.PDF'.
- README File:** A file upload field containing 'your-txt-here.TXT'.

At the bottom of the form is a large 'BACK' button. The footer of the page reads 'P2GreenN Innovation Platform v1.0.1'.

Figure 6: Display of an existing database entry, including ‘delete’ and ‘edit’ options (only available for entries from the user’s organisation).

Every data must have exactly one data file and one README file. Data formats are read automatically during upload. Data files can be uploaded in all formats, while README files are restricted to plain text (CSV or TXT), resulting in an error message if an incorrect format is detected. Alternatively, it is also possible to have only one upload field for data

and README files, instead of the two separate upload fields in Fig. 5. However, this would involve restrictions in the file names and formats (e.g. README always uploaded as “README.TXT”). As mentioned in Chapter 3.3.3 above, it is currently evaluated if the README file could also be created automatically based on the metadata entered in the data upload form (Fig. 5). This may require one or more additional field(s) on the form but would streamline the overall process. The IGZ will request feedback from the WP co-leads at the next data management meeting in M13 and coordinate further with the software developers.

One function that will also be implemented, but is not yet shown in Fig. 5, is the option to indicate that the uploaded data is sensitive and should not be shared with the public. The exact way in which this function will be implemented will be discussed with the consortium in connection with the IPR strategy (due M15). Depending on whether the data can be downloaded directly from the results list on the dashboard (to be decided), an indication of the data sensitivity is also displayed in the results list itself. Otherwise, it will appear in the data entry view when clicking on a specific result.

The data entry view (Fig. 6) will provide more detailed information on a selected entry, including the complete list of tags and the optional description text. In addition, the organization that created the entry is displayed (not shown in Fig. 6). Data and README files can be downloaded by clicking on the respective download buttons. Depending on the format, data files can also be directly viewed in the browser. Users will be able to edit or delete the data entries that belong to their own organization. Admins can edit or delete data entries from all users/organizations if necessary. At the moment, it is not foreseen that users can edit or delete data from other organizations. However, this can be changed during the project time if required. Otherwise, it is always possible to download a data file, change it and upload it as a new entry. To facilitate the sharing of individual data entries, each entry will have a unique URI that can be copied from the browser and send to other project partners as a link. To open the link, the project partner has to log in to the database.

5.4.3 Stakeholder network

As part of the public repository, an interactive stakeholder network is planned together with the project partner CERTH that is leading Task 5.1. External stakeholders will have the possibility to register on the IP and add their location to an interactive map, where filters can be applied according to the thematic focus and type of stakeholders (supported by different colors). By clicking on an entry on the map, details of the specific stakeholder will be displayed. These will presumably include:

- Name of the stakeholder
- Organization of the stakeholder
- A short free text description (optional)
- Organization profile/type of stakeholder
- Thematic focus

- Location/address
- Email contact
- Phone contact (optional)
- Logo/picture (optional)
- Website link (optional)
- Social media links (optional)

There will be a dedicated tick box, where a GDPR statement is linked, and where stakeholders have to agree to publication of their data on the IP. Optionally, stakeholders can select if they want to receive the P2GreenN newsletter and/or other information related to the project. Currently, it is also being investigated whether it is possible for stakeholders to link an existing profile, e.g. from their LinkedIn account, to facilitate the registration process and pre-fill most of the form fields. Regarding the thematic focus and stakeholder types, a pre-selection has been done in a co-creation workshop organized by Task 5.1:

Thematic focus:

- Water and sanitation
- Food, agriculture and green areas
- Waste Management
- Innovation and Investment
- Sustainability/Circularity
- Digitalization
- Social and education
- Sustainability/Circularity
- Urban Planning
- Construction
- Management
- Governance and Regulations
- Other

Stakeholder types:

- SME / private company / implementation actor
- Government and public administration
- Public company
- Research and academia
- Platform or network
- Project
- Cooperative, association or NGO
- Individual
- Other

6 Outlook

The complete development of the IP is planned to be finished in March 2024 (M16). The design of the public repository will be developed in close cooperation between the software developers, CIP and DMT and with feedback from the consortium. All project partners will be given access to the project-internal database as soon as there is a first operational version (projected in M13). This will allow us to adapt the platform functionalities based on the feedback of project partners before the development phase is completed. Minor adjustments will also be possible during the filling phase of the IP from M17 to M46, in the frame of the maintenance and support subcontract. During the filling phase, all methods and results that are generated within the project will be uploaded on the IP, including all relevant metadata. How the data files that were created prior to the establishment of the IP and stored on AGR's cloud-based platform (MS Teams and Sharepoint) are handled will be assessed together by the DMT and WP co-leads. This also includes how MS Teams and Sharepoint are further used, e.g. as a means for organizational tasks related to project management and for collaborative online editing of documents. Following the final DMP version in M46, the DMT will ensure that all data follows the therein specified requirements for long-term storage. While the data on the IP will be available for five years after the end of the project, it is intended that data that has been labelled as public will also be stored on a permanent repository such as the European Open Science Cloud (EOSC). The decision on how and where the P2GreenN data will be stored permanently will be part of the final DMP, which is implemented in M47 and M48. Ultimately, the IP will facilitate data exchange between the project partners with its annotated database in the project-internal area and contribute to making the methods and results of the project FAIR with its public repository.

7 Annex

	A	B	C	D	Participants in this task/deliverable				
1	Task number	Deliverable number	Deliverable Name	Short name of lead participant	Which input is needed from the project partners to fulfill the deliverable?	Which types of data are produced in this task/for this deliverable? (e.g. numbers for material flows, financial data,	What is the data format? (e.g. jpg, excel, .shp-file, .../ Text, numbers, pictures, maps)	Can the data be made publicly available (Yes/No -if no please describe restriction)	Which output can be given for general users? (e.g. politica guidance, recommendations for practice, ...)
2	1.1	1.1	Demonstration report on validated prototypes from the three case studies	evh					guidelines, checklists, decision making matrix
3	1.1	1.6	Progress in set up of pilot regions	EVH	photos, cost numbers, guidelines for monitoring	financial data, MFA (material flow analysis), quotes	jpg, pdf, text, excel, mp4 (video)	yes	
4	1.1	1.6	Progress in set up of pilot regions	EVH	photos, cost numbers	quotes	jpg, pdf, docx	yes	lessons learnt, mapping of hurdles
5	1.2	1.2	Report on progress of maturing system readiness level in the three pilot regions	SLU	R&D activity report	cost numbers, maintenance monitoring, personal hours	.docx, excel, jpg	no	state of the art & outlook
6	1.2	1.3	Report on progress of maturing system readiness level in the three pilot regions	SLU	R&D activity report	cost numbers, maintenance monitoring, personal hours	.docx, excel, jpg	no	state of the art & outlook
	1.3	1.4	Blueprints from the three pilot regions	BioA	- smoothend guidelines, condensed knowledge, appealing visual material, organisational learnings - Identified barriers and drivers, adequate incentives, policy and	flow charts, guidelines, financial data, MFA - documents, reports	.docx, excel, jpg, dwg	yes	guidelines, checklists, decision making matrix stakeholder mapping

Figure 7: Excel file used by the DMT ('IP Deliverable Overview') to identify which data is collected in each Task and Deliverable, and which data needs to be exchanged between different WPs and Tasks – Part 1/3, data collection in each Task/Deliverable (excerpt).

	A	B	C	D	J	K	L	M
1	Task number	Deliverable number	Deliverable Name	Short name of lead participant	Receivers using data from this deliverable			
2					Who is the receiver?	Which information is needed? (e.g. Information about use case -> specific address/ area; numbers for P+N flows, numbers about general costs of the technology, legal restrictions, ...)	Where is this information coming from? (e.g. Workshop, survey, by pilot regions, from field trials, by Project partner X, ...)	Requested data format of the information (e.g. .jpg, excel, .shp-file, .../ Text, numbers, pictures, maps)
15	3.2	3.2	Report on current urban planning framework and local challenges and opportunities for implementation	HCU	Decision makers in urban planning		Governance analysis, legislative analysis, pilot and follower regions	Text, map, pictures
16	3.3	3.3	Lessons learned and recommendations on action for user acceptance	ENPC	Researchers + Operational actors in the city and the agricultural world likely to get involved in source separation projects and agricultural recovery of excreta	Analysis of issues and barriers related to the acceptance of users, but also to all the actors involved in the daily management of buildings and the use of fertilizers from excreta. Analysis of organizational forms and modes of governance at work	Cases study (Saint-Vincent-de-Paul project in Paris and other projects of excreta source separation and valorization in Île-de-France)	Text, pictures and maps
17	3.3	3.4	Report about the societal acceptance and recommendations for improvement	IRS	Stakeholders, policy makers, decision makers		Focus group interview as part of the workshops, survey	Text
	3.3	3.5	P2Green Videogame elaborated in T3.3.2	IAAC	Technology providers,	Description of barriers of acceptance		

Figure 8: Excel file used by the DMT ('IP Deliverable Overview') to identify which data is collected in each Task and Deliverable, and which data needs to be exchanged between different WPs and Tasks – Part 2/3, data requirements of other partners from specific Tasks/Deliverables (excerpt).

	A	B	C	D	N	O	P	Q
1	Task number	Deliverable number	Deliverable Name	Short name of lead participant	Senders providing data to this deliverable			
2					Who is the sender?	Which information can be given to this Deliverable? (e.g. Information about use case -> specific address/ area; numbers forP+N flows, numbers about general costs of the technology, legal restrictions,	Can the data be made publicly available (Yes/No -if no please describe restriction)	In which data format? (e.g. jpg, excel, .shp-file, .../ Text, numbers pictures, maps)
32	T5.3	5.5	Report on results of actions for knowledge exchange and capacity building (4 focus groups) providing focus groups results	CERTH	Partners in follower regions	Notes/recordings of focus groups. Analysis of outputs of follower regions.	Yes, without contact details	Text
33	T5.3	5.6	Report on results of actions for knowledge exchange and capacity building (8 workshops in follower regions and 2 EU-wide workshops)	CERTH	Partners in follower regions	Experience and findings from WPs 1, 2, 3 and 4 to share information on an EU-level. Notes/recordings of workshops. Analysis of outputs of follower regions.	Yes, without contact details	Text
34	T5.3	5.7	Report on results of actions for knowledge exchange and capacity building - final report	ICLEI	Partners in follower regions	Experience and findings from WPs 1, 2, 3 and 4 to share information on an EU-level. Notes/recordings of workshops. Analysis of outputs of follower regions.	Yes, without contact details	Text
	T5.4	5.8	Replication Action Plans for Follower Regions	IAAC		Information about technologies, policy already existing or policy programmes in the cities related to the use of land and		

Figure 9: Excel file used by the DMT ('IP Deliverable Overview') to identify which data is collected in each Task and Deliverable, and which data needs to be exchanged between different WPs and Tasks – Part 3/3, provisions of data from other WPs/Taks to a specific Task/Deliverable (excerpt).



Figure 10: Miro board with suggestions for IP functions and features from the consortium members.

	A	B	C	D	E
1		Required information	Explanation and examples	Input field	
2		General information: Header with general metadata of the corresponding data file			
3		Work package	WP from which the data was collected	Select from list	
4		Task	Task to which the data belongs		
5		Responsible organisation	The organisation that collected the data		
6		Authors(s)	The person(s) who entered the data		
7		Confidentiality of data	Indicate here if the data is sensitive (only for project-internal use) or not (publication possible)		
8		Description	Brief description of the data (free text)		
9		Data file name	This needs to refer exactly to the filename containing the data, (e.g. "Data_P2Green-WP2-Sweden_20230801.xlsx")		
10		File type	Specify the file format (e.g. "Microsoft Excel", "Text", "PDF")	Select from list	
11		Number of data points	This field needs to be filled with the number of individual data entries (rows)		
12		Creation date	The date when the file was first created		
13		Date modified	The date when the last modification occurred		
14		Version	A whole number, starting from 1 and updated for each modification step (e.g. if the original file version 1 was updated twice the most recent file version is 3)		
15		Background information: Metadata that is needed for understanding the collected data			
16		Geographical location	Where the data was collected, as detailed as possible (e.g. 'German pilot region, field trial')		
17		Site operator	Only relevant for data from treatment plants and field trials		
18		Soil type	Only relevant for data from field trials		
19		Studied crops	Only relevant for data from field trials		
20		Included treatments	Only relevant for data from field trials (e.g. Unfertilised control, Recycling fertiliser, Mineral fertiliser control, Organic fertiliser control)	1. 2. 3. 4.	

Figure 11: Draft version of the metadata template developed by Task 2.1.

Table 2: Online platforms that were listed as examples by the consortium during the DMP and IP workshop in M4.

Platform/project name	Platform content	URL
REFLOW	Collaborative Governance Toolkit	https://governance.reflowproject.eu/
European Cluster Collaboration Platform	European online hub for cluster stakeholders	https://clustercollaboration.eu/
Hubs4Circularity	Knowledge platform and network hub for industrial symbiosis, industrial-urban symbiosis and circular economy	https://www.h4c-community.eu/
CIVITAS	Knowledge platform for sustainable and smart mobility	https://civitas.eu/about#knowledge-bank
Egestabase	Database with scientific publications and implementation examples on the recycling of nutrients from human excreta and municipal wastewater	https://egestabase.net/EVI3/
HOLY SHIT	Global film and impact campaign on the recycling of nutrients from human excreta with a variety of background information	https://holyshtit.global/
YOU DON'T KNOW SHIT	Graphic-based platform explaining the benefits of circular urban-rural nutrient flows	https://www.ydks.de/
Sustainable Sanitation Alliance (Susana)	Network hub and knowledge platform for stakeholders interested in sustainable sanitation practices	https://www.susana.org/en/
BUILD UP	European portal for energy efficiency and renewable energy in buildings	https://build-up.ec.europa.eu/en/home
BioRural Toolkit	Network hub and knowledge exchange platform for rural bioeconomy stakeholders	https://biorural-toolkit.eu/
CICERONE	Circular economy platform for knowledge sharing, networking and co-creation	https://cicerone-h2020.eu/

Project Number:
Project Acronym:

101081883
P2Green
Deliverable 7.2

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